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Grinding in the Railroad Shops

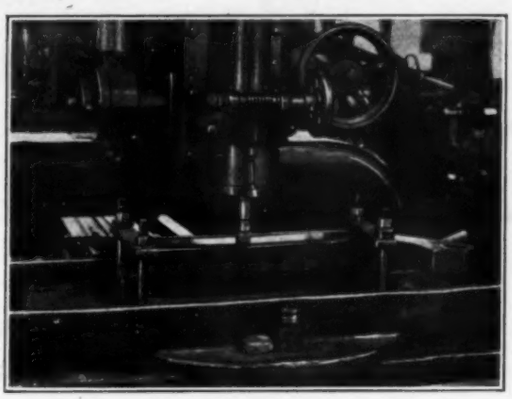
By HOWARD CAMPBELL
Western Editor, *American Machinist*

Illustrations and data collected from various railroad shops where grinding machines are used on a variety of work—The wide range covered is of unusual interest

IN COLLECTING these illustrations and the data which accompany them it has been my aim to show something of the growth of grinding in railroad shops and to point out the variety of work that is being ground in some of them. The detailed information is given as concisely as possible so that anyone may easily compare the results with those obtained in his own shop.

It is hardly to be supposed that the best wheels, feeds and speeds are being used in all cases. There is perhaps more difference of opinion regarding these three factors than on anything else in the shops. Even in shops where grinding is an old story, there is a vast difference in the methods found.

The examples given will, however, serve to show that advances are being made in railway shop practice in many shops. In too many instances the shops are handicapped by inadequate equipment and in cases where the methods differ from those of large production shops it is because the only equipment available must be used. Instances of this are shown in Figs. 1 and 2. The first shows a standard machine for link grinding while in the second is a home-made device for doing the same work. Needless to say the work is done without the planetary movement of the head of the cylinder grinder. The slot in the link, shown in Fig. 1, is cut from the solid with a gas torch using a templet. It is finished approximately to size on a slotter. Time required to grind a new link is from 3 to 4 hr. To repair a link with a bad twist, such as when badly worn, 3 to 4 hr. The link shown is of case-hardened wrought iron with $\frac{1}{32}$ in. left by the slotter, for grinding. The wheel is wide enough to cover the work and moves up and down vertically for $\frac{1}{8}$ in., 27 times a min. The time for work to travel past wheel and return is 22 seconds.



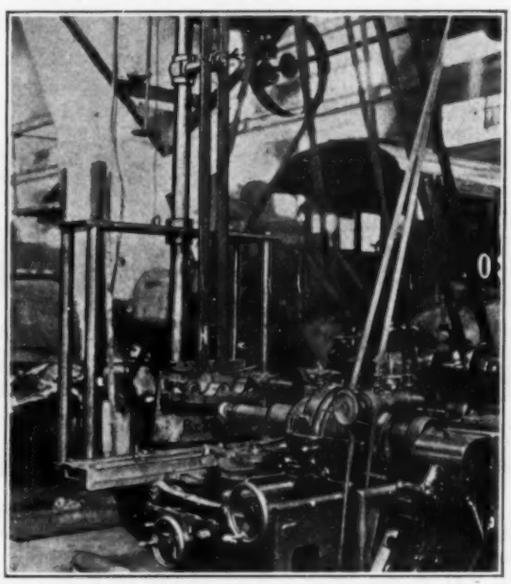


FIG. 1—NEWTON LINK GRINDER. FIG. 2—SECTION OF LINK ON MADISON INTERNAL GRINDER

The work shown in Fig. 2 is clamped to piece *A* which is held by pin *B* to angle plate *C*, the latter being bolted to table of machine. Piece *A* is held by a swivel at point *D* so that as machine reciprocates, the plate *A* swings on pin *B* and the desired radius is ground on the piece. A sectional link is composed of four pieces, each of which is ground in approximately 15 min., making 1 hr. for the link.

The material is case-hardened steel with enough material to just clean up and is ground dry. Wheel is carborundum 36-H, running 7,500 r.p.m. The feed is 10 ft. per minute.

Railroad shopmen are fully alive to the possibilities of grinding in many cases. They are very apt to point out work which they would like to grind if they had the proper equipment. And it must not be forgotten that by equipment we must include a sufficient supply of proper grinding wheels as well as the machines themselves.

It will, unfortunately, require considerable education to bring railway purchasing agents and those who control the order of supplies to the point of ordering the exact wheels specified and, unless the proper wheel of the correct grade is supplied, the best results cannot be obtained. Those who are not familiar with grinding can hardly be expected to appreciate the fact that,

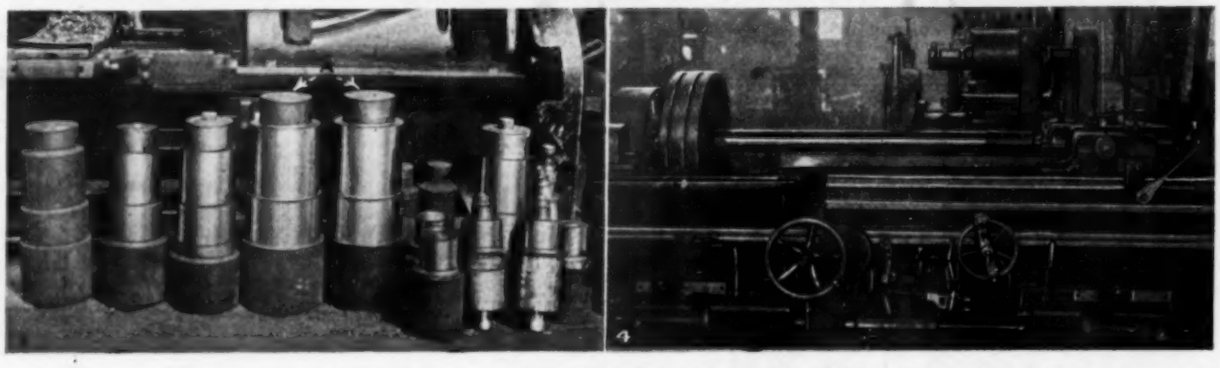


Fig. 3 — Large crankpins *A* are ground on the 9 and 10 in. diameters. Old method includes rough and finish turning and rolling. Time, 3 hr. 45 min. complete. Pins are now ground on Norton grinder. Time, 2 hr. 15 min. complete. The small crankpins took 2½ hr. each to turn and roll; to turn and grind 2 hr. each.

Fig. 4—Piston rod on 90-in. Norton gap grinder. Rod, 4½ in. diameter. Wheel, 24 x 3¾ x 5 in. hole. Grain, 24-C. Grade, K alundum. Cut 0.002 in. Old method included roughing and finishing cuts and rolling. Time, 2 hr. Present method rough cut, then grind. Grinding time, approximately 25 min.

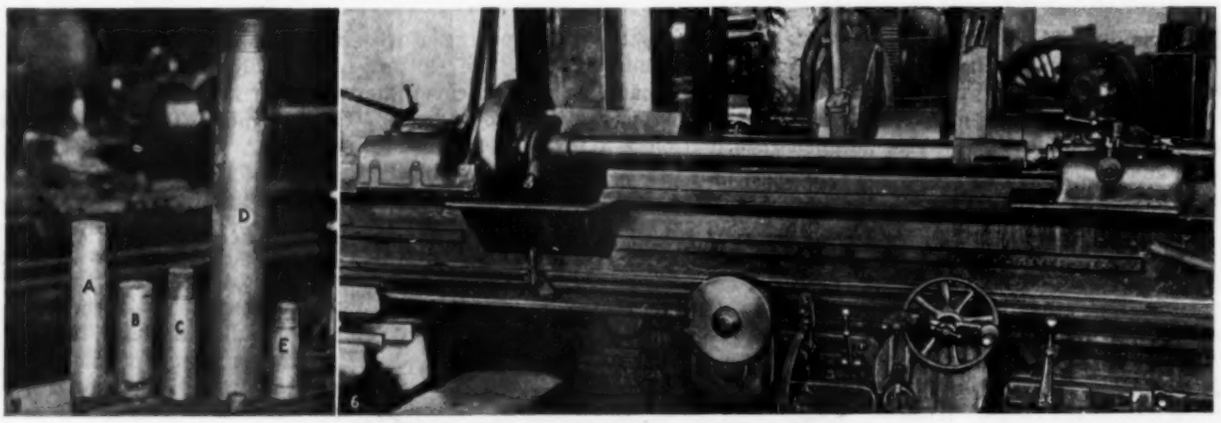


Fig. 5 — Work done on Landis grinder. Amount left for grinding, $\frac{1}{32}$ in. Time: *A*, 3 bearings, 15 min.; *B*, 3 bearings, 10 min.; *C*, 1 bearing, 5 min.; *D*, 1 bearing, 30 min.; *E*, 1 bearing, 5 min. Wheels used, 12 x 1 x 5 in., 46-M aloxite and 14 x 1¼ x 5 in., 46-M aloxite.

Fig. 6 — Piston rod in Norton grinder. Material, steel. Clean up on repairs; $\frac{1}{32}$ in. stock left for grinding on new rod. Wheel, 24 x 3¾ x 5 in. hole. Grain 24-C. Grade K alundum. Traverse: roughing, 3 ft. per min.; finishing, 1 ft. per min. Work speed, 16 r.p.m. Cut, 0.002 in. Time, new rod, 45 to 60 min.; worn rod, approximately 30 min.

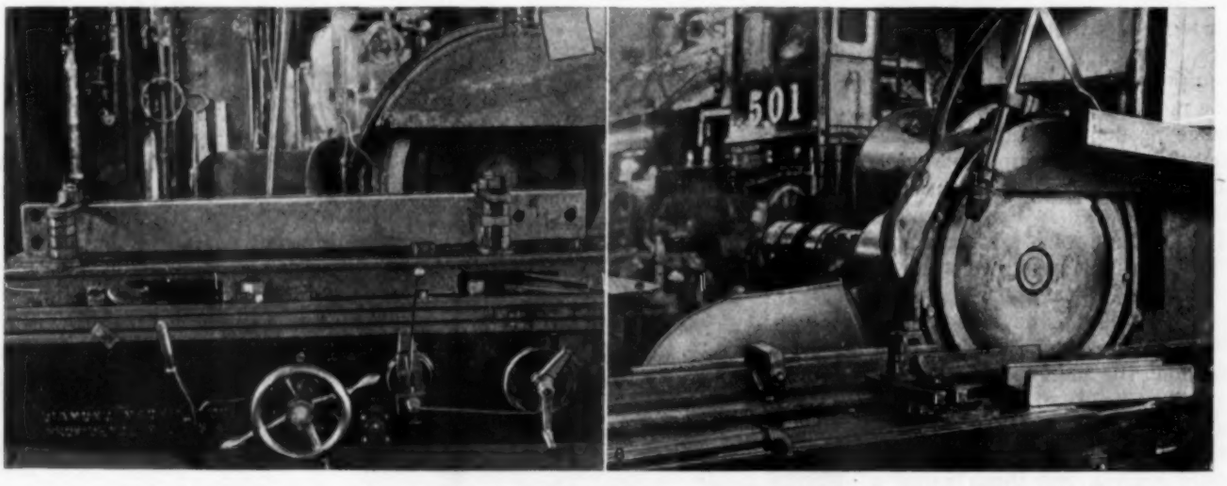


Fig. 7 — Grinding guides on Diamond grinder. Repairs only. Material, steel forging. Held by clamps. Wheel, carborundum ring with 2 in. surface. Speed 700 to 800 r.p.m. Feed, 0.001 in. per rev. Depth of cut 0.001 in. Stock, $\frac{1}{32}$ to $\frac{1}{16}$ in. on a side. Grinds face and sides of bottom guide; top guide on face only. Grinds from 4 to 6 guides in 8 hr.

Fig. 8—Grinding shoes on a Diamond grinder. Material, cast iron. Usually takes 0.006 to 0.008 in. at a cut. Wheel, 30 x 6 x 26 in. Speed, 400 r.p.m. Traverse 16 ft. per min. First planed on inside, then ground on outside. Stock allowed for grinding $\frac{1}{32}$ to $\frac{1}{16}$ in. Time 8½ min. per shoe.

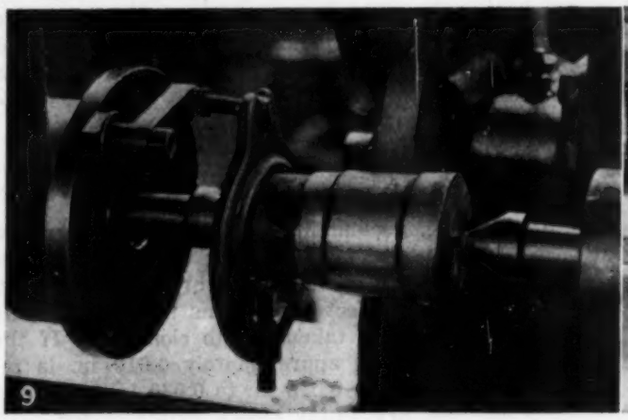


Fig. 9 — Grinding case-hardened link pin on Landis grinder. Material case-hardened forging. $\frac{1}{64}$ in. total stock left for grinding. Wheel, 46-M aloxite, 14 x 1¼ x 5 in. Wheel speed, 1,500 r.p.m. Work speed, 140 r.p.m. Depth of cut, 0.002 in. Limits, 0.002 to 0.005 in. Grind to running fit in bushing.

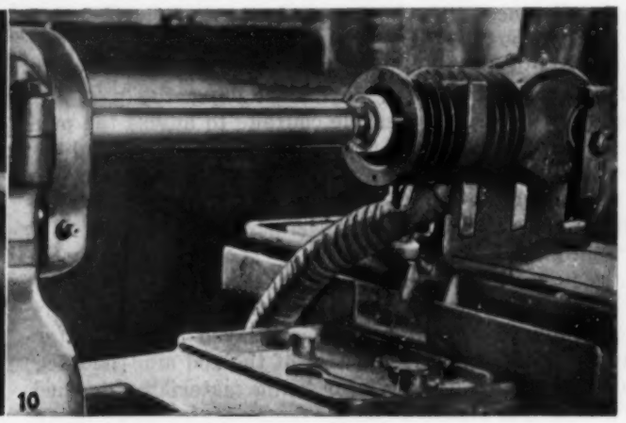


Fig. 10—Grinding barrel of Mudge gas-engine cylinder for inspection car. On Heald cylinder grinder. Piece held by angle plate, bolt and strap (fixture will be made). Wheel 36-I, crystolon, 3½ x 1 x 1¼ in. Speed, 6,900 r.p.m. Feed, approximately 0.15 in. Cuts, rough 0.001 in., finish 0.0005 in. Grind 0.010 in. in 40 min.

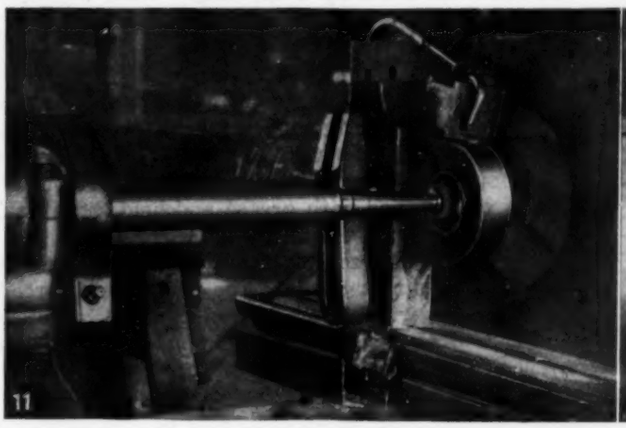


Fig. 11—Grinding hole in knuckle-pin bushing in middle side rod on Heald cylinder grinder. Material, case-hardened steel. Wheel, 50-M, aloxite. Speed, 3,600 r.p.m., spindle circling in hole at rate of 34 r.p.m. Amount of stock, 0.010 in. Hole 3½ in. diam. x 2 in. long. Grind to slip fit on pin. Set up and grind, 1 hole 30 min.

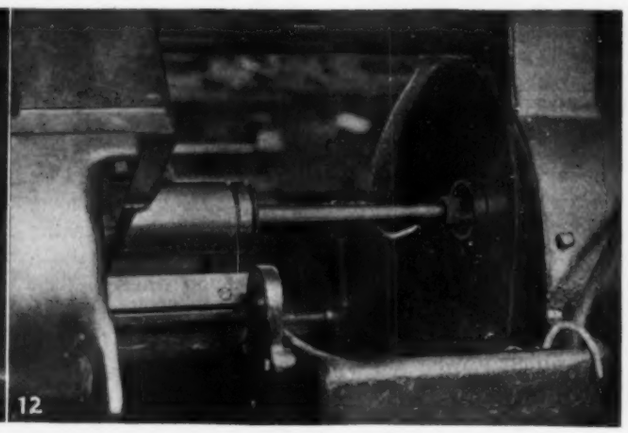


Fig. 12—Grinding steel link-bushing in Bryant chucking grinder. Dimensions, 2¼ in. inside x 4 in. long with ⅛ in. wall. Wheel, 2 x ⅝ in. Speed: Wheel, 2,200 r.p.m.; work, 180 r.p.m. Amount of stock for each bushing 0.005 in. Limit, 0.005 in. Time, 10 to 15 min.

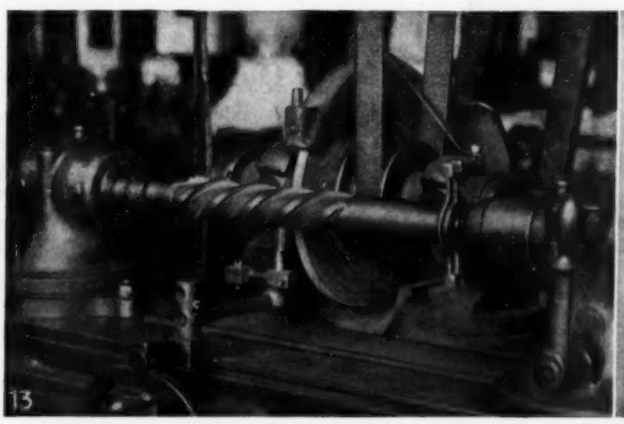


Fig. 13—Grinding helical cutter for milling ends of side rods on Brown & Sharpe No. 2 grinder. Tooth support bolted to machine by two bolts through ends of curved section at front and bolted to machine under wheel bearing, making rigid support. Wheel, 60-M, aloxite, 12 x ½ x 5 in. Speed, 1,200 r.p.m. Time, 15 min. each.

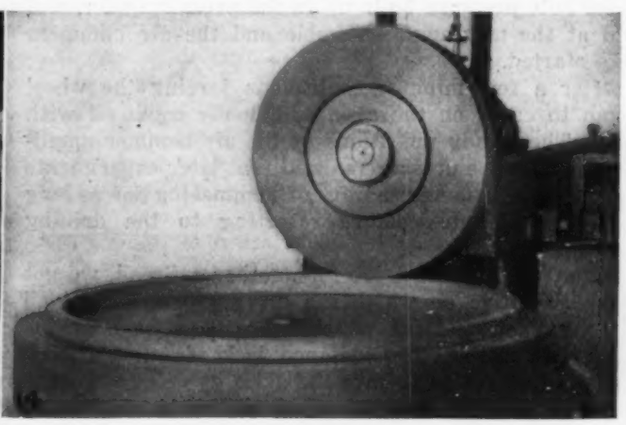


Fig. 14—Grinding 15$\frac{7}{16}$ x ⅝ x 1$\frac{1}{32}$-in. ring for piston valve on machine built by Locomotive Finished Material Co. Magnetic chuck will take 24 in. ring; auxiliary chuck will grind 44 in. diameter. Wheel, 2 x 14 in. Hand feed. Work speed, 42 r.p.m. Stock 0.010 in.; 0.005 in. on a side. Production, 50 to 60 rings per hr.

though all grinding wheels may look alike, there is a vast difference if the best work is to be secured.

The various illustrations deserve careful study and it must be remembered that the examples shown represent a marked step in advance during the past five years. It takes considerable courage to advise the purchase of equipment which is entirely of a new kind for the shop. Nor is it always easy to get a fair trial for a new machine, both on account of the physical difficulties and of the inertia of the personal element. But grinding is growing in railway shops and these examples may help to encourage others.

In the case of the piston rod shown in Fig. 4, the men emphasize not only the time saved but the difference in finish, the straightness of the rod and the effect on the rod packing, the wear being materially lessened.

In Fig. 8 is shown a change from planing to grinding. Patterns were changed so that there is only about $\frac{1}{32}$ in. to $\frac{1}{16}$ in. stock on the outside of the casting. A string of six castings is held by clamps to the bar as shown, and the first side cleaned up. The shoes are then turned and finished to size. The cost of planing is 23 cents each and of grinding, 12 cents each.

When these shoes were planed there was a machining allowance of $\frac{1}{4}$ to $\frac{3}{8}$ in. of metal. This has been reduced from $\frac{1}{32}$ to $\frac{1}{16}$ in. for grinding. The shoes are first planed inside to fit frame pedestal, then ground to size on the outside. Some of the comparative times are as follows:

	Planing Time	Grinding Time	Planing Cost	Grinding Cost	Saving
Valves	16 min.	8½ min.	23c.	12c.	11c.
Shoes	50 min.	18 min.	70c.	25c.	45c.

Rough and finish ground in one operation, six ground at once.

In Fig. 10 a finish cut is taken through and return twice, to insure a perfect bore. This is a small repair job so just enough is taken out to clean up. If the cylinder is not scored, approximately 0.010 in. is removed; if scored, from 0.015 in. to 0.020 in. The machine is operated dry. Link blocks, cylinders for operating butterfly fire-box doors, valve guide blocks, etc., are also ground on this Heald cylinder grinder.

The Heald cylinder grinder, shown in Fig. 11, is also used to grind the case-hardened steel bushing for floating bushing, in the back end of the main rod. The hole is 9 in. in diam. by 7 in. long. Time complete, 2 hours.

Railroad Shop Repair Work—Discussion

BY CHESTER LYNNDELLE

The article on page 600, Vol. 59, of the *American Machinist*, by I. B. Rich, under the title given above, mentions a series of 1-in. holes being drilled across the face of an axle to free a tight wheel. This recalls a somewhat similar experience in the shop where I first worked at locomotive repairing. We had a press for removing wheels, and in this case a set of drivers came in for which it was imperative that the axles be preserved intact.

When the press, with as much of a pressure overload as possible, failed to start the wheel, we rigged up a sling and brace to hold two heavy air hammers, on opposite sides of the axle and parallel to it. The grips were backed with formed rubber pads to permit just enough "give" to the support to eliminate breakage. The hammer dies were set against the inner side of the wheel hub, pressure built up in the press cylinder, and held at the maximum allowable and the air hammers were started.

After a few minutes continuous jarring the wheel began to creep on the axle, and finally came off with ease. The steady pulsations of the air hammer amplified the effective pressure so well that later experiments demonstrated the advisability of hammering for as long as fifteen minutes before resorting to the drilling method.

Later, on a contract job for another railroad, we got in a locomotive on which the driving brasses had all run very hot, and the wheels were very tight on the axles. As in the other instance, lack of suitable stock made it imperative to save the axles or delay the work for we were under a time contract that meant money one way or the other, depending on the delivery date.

Our pet air-hammer scheme failed to free the wheels, and it was finally decided to telegraph for new axles, but in the meantime we decided to try a new plan. We had four ¼-in. holes drilled into the joint between wheel and axle, carrying their depth to within 2 in. of the axle shoulder. The outer ends of these holes were then reamed and tapped for ⅛ in. pipe thread, the holes filled with a light oil (of the type used for auto spring lubrication), and standard automobile pressure lubrication system couplings screwed in. A pressure of 3,000 lb. per sq.in. was applied with grease and held there until oil showed at the shoulder under the wheel.

The success of the scheme was astonishing, even to the foreman originating it, and the wheel yielded readily to the press without the aid of the air hammers. The oil spread as soon as the wheel began to move; but we were able to determine from the darkened areas that the oil under pressure had found its way to a distance of nearly 2 in. on each side of the holes, relieving the grip of the hub enough for the press to function.

The small drill holes in both wheel and axle were electric welded and faced off to the proper arc, without reducing the strength of either part appreciably, and the engine was repaired and delivered before the new axles arrived.

New Glycerine-Water Quenching Medium

In connection with the investigation made by the Bureau of Standards of steels for the manufacture of precision gages, an effort has been made to find a quenching medium intermediate between oil and water. During the past month, quenching curves were taken of specimens cooled in water solutions of glycerin. Such solutions fill the gap effectively, so far as the cooling rates at high temperatures are concerned. On the other hand, glycerin and its water solution cool distinctly faster in the lower temperature ranges than quenching oil. This appears to be a desirable property.

As a commercial quenching medium glycerin or its water solutions should not be unduly expensive, for although the first cost is high, glycerin does not decompose to any great extent on heating, as is the case with oils. The composition of glycerin-water solutions may be easily maintained by hydrometer tests. The solutions do not give off irritating fumes and are harmless to the worker.

How Rivett Makes Spring Collets

SPECIAL CORRESPONDENCE

Formed upon Gridley automatics — Held upon centers in succeeding operations — Turning and threading on engine lathes — Sawing the slots — The final grinding

SPRING collets for bench and toolroom lathes have long since become so familiar an adjunct of the toolroom that the average user accepts them as a matter of course, with little or no thought of the problems or processes of the manufacturer. Any toolmaker will acknowledge that the making of a single true-running collet of accurate size is a job that calls for no small degree of skill and consumes a considerable amount of time, and, being confronted with such a job, he may be curious to know how collets are made in quantities when every step must be carefully calculated to secure the greatest amount of product in a given time without sacrifice of accuracy or finish.

The name of Rivett upon a spring collet has long been accepted as a guarantee of excellence. The Rivett Lathe & Grinder Corp., of Boston, Mass., has been making collets for bench and toolroom lathes, small grinders and similar machines for many years, and it is from this factory that the data and photographs from which this article was prepared were obtained.

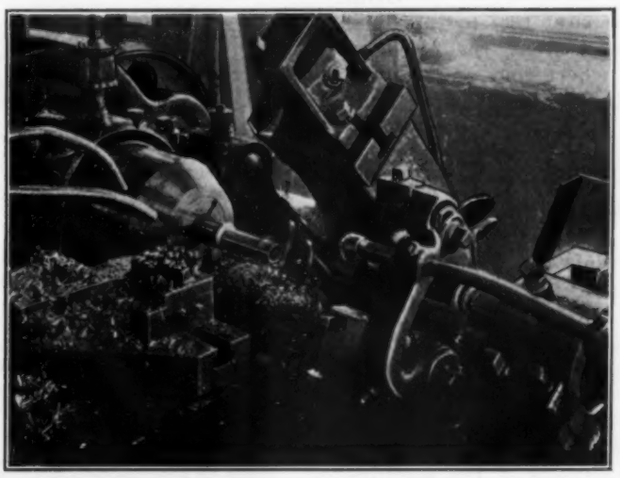


FIG. 1—FORMING COLLETS ON THE GRIDLEY

The raw material from which collets are made is received at the factory in the shape of hot-rolled bars of Sanderson No. 4½ temper tool-steel about $\frac{1}{32}$ in. larger than the largest diameter of the finished product. Though collets are made by the Rivett Co. to hold from $\frac{1}{8}$ in. down to 0.010 in. in diameter, there are but seven sizes so far as concerns outside diameters and lengths.

The first steps toward the production of the finished collets are made in the Gridley automatics, one of which is shown in Fig. 1, which reduce the bar stock to the familiar appearance of the collets as shown in Fig. 2, at the rate of 10 pieces per hour for the smallest sizes down to 5 pieces per hour for the larger ones. One operator runs several machines. In this machine the pieces are successively spot-centered, shouldered for threading portion, the stock at the center of the bar removed by drilling and the body turned to size, plus grinding allowance, by tools held in the turret. In the final turret position, a steady rest supports the outer end of the piece while a form tool in the cross-slide is shaping the beveled head and the piece is being severed from the bar by a tool held in the cut-off arm.

No threads are cut on the Gridley machines, and no through hole is made at this stage. Ordinarily it is not known at this time what the nominal holding size of the collet is to be and therefore the large drill that takes out the stock at the center is stopped at a distance from what is to be the finished face of the collet of about twice the average nominal holding diameter for the range of holding sizes this particular body size is expected to cover.

The cut-off tool is purposely shaped to leave a substantial tit, or projection, at the point of severance, as may be seen in Fig. 2, when the piece is separated from the bar of stock, and advantage is taken of this projection to make a male center at this end upon which to support the individual collets while undergoing succeeding operations.

As all collets of any one lot are now of a uniform (though not standard) size, they can themselves be held in special spring collets of larger capacity. By this means they are held in the spindle nose of the hand screw-machine shown in Fig. 3 while a form tool in the cross-slide reduces the projection left by the cut-off tool of the Gridley to a standard 60-deg. male center.

The pieces then go to a bench lathe where they are held by means of the male center at one end and upon a steady rest at the other while the open end is chamfered to a 60-deg. angle, thus providing a female center at this end. In all subsequent operations the collets are supported in the machines by these centers.

The next two operations are performed upon standard engine lathes, and have to do with the thread by means of which the draw-bar engages the collet when in service and pulls it back against the beveled sleeve in the spindle of the machine—the feature from which the spring collet derives its popular designation of "draw-in chuck." It will be remembered that no thread was cut during the preliminary operation upon the Gridley machine, and this omission is because it is desired to make the male and female centers upon which the work can now be supported the basis, or point of departure, for all operations affecting concentricity.

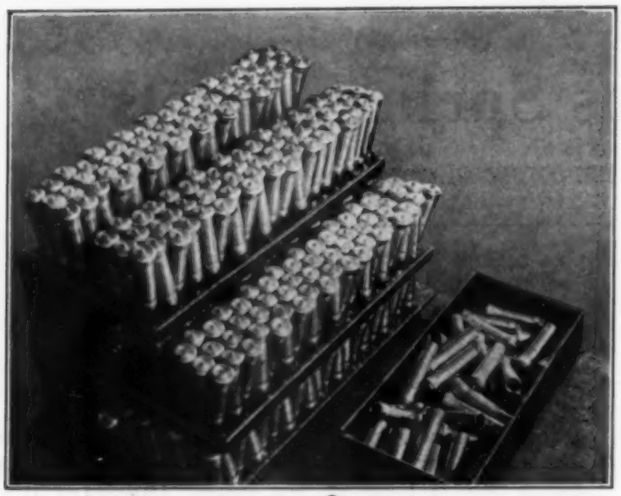


FIG. 2—METHOD OF HANDLING THE WORK

Therefore the shoulder at the rear end of the collet, upon which the thread is to be cut, and which was left a few thousandths oversize by the tools of the Gridley, is now turned with a single point tool to the finished outer diameter of the thread. Next, the pieces pass to another and similar lathe where they are again supported upon the centers while the thread is cut.

The threading tool, shown in position in the lathe in Fig. 4, is the well-known "Rivett" device, resembling a ten-tooth milling cutter in which the first tooth is but a rudimentary thread form while each succeeding tooth approaches more nearly to a full 60-deg. V until the tenth tooth is reached, which is a full formed threading tool. The carriage of the lathe is traversed back and forth in the manner usual to thread cutting in engine lathes and the cutter is rotated and locked in position at each successive tooth at each pass until it has passed ten times over the thread and the latter is completed.

In each collet there is a short keyway to engage with a corresponding key in the spindle of the machine in which the collet is to be used, to prevent the latter from turning with relation to the spindle. This keyway is next milled in a hand milling machine in which the work is held in a fixture that supports it from the centers.

The next operation is that of grinding the body of the collet to finish size, performed in a standard Norton grinding machine in which the work is supported by the centers. A "set" wheel is used and the work is fed straight toward the wheel without traverse. The second grinding operation, that of grinding the 30-deg. angular gripping surface under the head of the collet, is done in the same way with the wheel head set at the corresponding angle.

A few minor operations follow, such as stamping the trademark on the body of the tool, removing burrs, and rounding over the end with a handtool; the latter operation being performed in a bench lathe in which the collet is held in the spindle by the regular draw-bar. This operation removes the male center upon which the turning and grinding operations have been done, and leaves a slight depression that is truly central with the collet for the purpose of starting the drill in the next operation; which is drilling the hole that constitutes the holding part of the collet. This hole is not, however, drilled at this stage. Instead, the collets go to the stock room as "semi-finished" blanks.

It would be impossible for the manufacturer to forecast the demand for specific sizes of collets and to meet all orders with immediate shipments would necessitate a prohibitively large stock of the finished product.

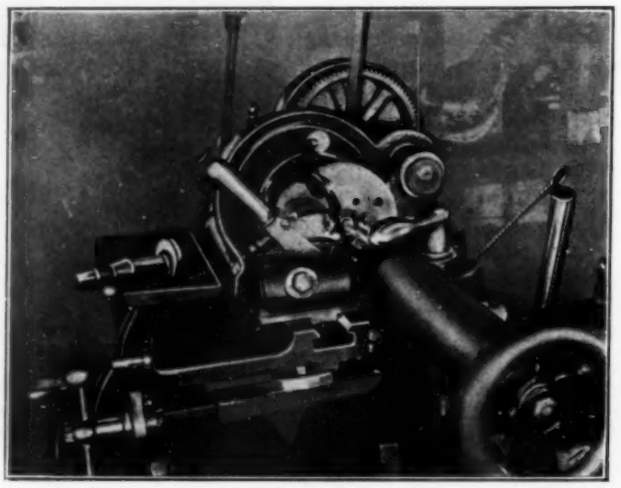


FIG. 4—CHASING THE THREAD FOR THE DRAW-BAR

Therefore the collets are thus held in the stock room as semi-finished material, to be drawn upon and put through the final operations that determine the actual holding sizes as the orders demand. A suitable number of completely finished collets of the sizes most used is also carried in stock.

The first operation in the second stage, when the collets have been issued from the stock room upon specific order, is drilling and reaming the hole. This is performed in a small hand screw-machine in the spindle of which the collets are held by a draw-bar in the usual manner, for at this time they are finished so far as the exterior surfaces are concerned. A hole is drilled and reamed in each collet to a diameter from 0.005 to 0.007 in. below the nominal holding size as specified by the order.

The holding size—$\frac{1}{8}$, $\frac{1}{4}$, $\frac{1}{2}$, etc., as the order may indicate—is then stamped on the face of the collet and it goes to the hand milling machine shown in Fig. 5 to be slit. In this illustration the actual operation shown in the slitting of some special "push" collets of a kind not regularly included in the line of manufacture, but the fixture is the same as is used on the regular work. A separate fixture is required for each size (body size)

FIG. 3—FORMING THE MALE CENTER ON THE OUTER END

FIG. 5—SLITTING, OR "OPENING" THE COLLETS

of collet and the regular collet is, of course, almost wholly within the fixture; the saw being guided by a slot in the steel bushing.

If the size is to be ¼ in. or larger, a single saw is used to cut clear through to the central hole and open the collet. If the collet is under ¼ in. but is ⅛ in. or more, the saw cuts down but part way and leaves a small amount of material surrounding the hole. A thinner saw, taking up the work at the bottom of the kerf left by the first saw, completes the cut.

On collets less than ⅛ in. and down to 0.010 in. in diameter the saw is not allowed to reach the center

FIG. 6—THE FILE USED TO OPEN THE SMALLER COLLETS

hole but stops at a distance from it depending somewhat upon the size of the hole and the collet is then opened by means of the file shown in Fig. 6, the thickness of which at the center is such that it fits smoothly in the kerf left by the saw and from thence bevels to a knife-edge either way. The filing is carried just far enough to separate the stock but not far enough to remove an appreciable amount of material from the circumference of the hole.

The collets are now ready for hardening and tempering. Contrary to popular belief they are not "sprung"

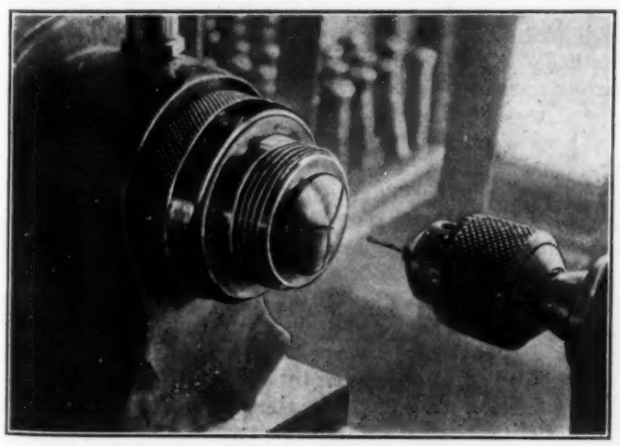


FIG. 7—GRINDING THE HOLE

open previous to the hardening, nor are there any separators placed in the slots. They are heated in muffle furnaces, quenched in oil and tempered in an oil bath.

The final machining operation is the grinding of the hole. Though care and skill are essential in all the preceding operations the value of the collet in the last analysis is dependent upon the roundness and truth of the hole, and all the painstaking effort thus far expended upon the product would be lost unless accuracy in this respect were attained.

The grinding is done upon Rivett No. 102 internal grinders with headstocks specially designed and built for the purpose in the Rivett shops. The operation is true grinding—not lapping—for even upon the smallest holes the grinding medium is smaller than the hole and grinds only upon one side of the latter.

Upon the larger sizes, down to $\frac{7}{16}$ in., ordinary abrasive wheels may be used, the manner of mounting them upon the spindle depending somewhat upon the size. Wheels over ½ in. in diameter are held by a round head screw and the smaller sizes with solder.

From $\frac{7}{16}$ in. downward the grinding is done with metal rods charged with abrasive. Copper and hard brass may be used on holes that are large enough so that rods of corresponding size are able to withstand the necessary side pressure; drill rod upon smaller sizes; and semi-hard needle wire upon the smallest sizes. Aluminous oxide and silicon carbide abrasives are used as a grinding medium for the comparatively larger sizes and diamond dust upon the very small ones. The collet shown in Fig. 7 is of ⅛ in. diameter and the grinding rod is hard brass, charged with carborundum.

There is no secret or mystery about the grinding; it is merely a case of keeping at it until the job is done. To grind a collet of 0.010 in. holding diameter, round, true and accurately to size, may take several hours of the time of a specially skilled operative.

This will serve to explain why the cost of a collet is apparently high and increases as its nominal holding size diminishes. If it departs from any of the above mentioned characteristics by even the small fraction of a thousandth it is no longer a valuable tool but a worthless piece of scrap; no matter how carefully the preceding operations have been carried out.

The Melting of Sponge Iron

Experimental work on the production of foundry iron from sponge iron in the electric furnace, performed by the Department of the Interior at the Seattle station of the Bureau of Mines, demonstrated that technically, at least, the process is a success, though large-scale tests are necessary to determine its commercial applicability. Such a process would find application in melting iron in regions remote from blast furnaces, or where establishment of blast furnaces would be impracticable. Sponge iron was melted in batch runs and continuous runs, in various types of furnaces.

The type of furnace found best fitted for the continuous melting of sponge iron is a deep pit furnace with a single electrode and a conducting hearth. The main problems solved were: High recovery of iron, clean separation of the slag, obtaining metal of a high-carbon content, introduction to the metal of silicon and manganese from the slag to eliminate the necessity of using ferro-alloys, and, finally, the removal of sulphur. In order to produce the best quality of gray iron, an auxiliary furnace would be necessary.

Increasing the Salesman's Useful Time

"THE management of a representative's time is often the cause of his success or failure," is one of the statements in a business leaflet on "Methods of Organizing Salesmen's Time" that has recently been gotten out by the Policyholders Service Bureau of the Metropolitan Life Insurance Co. The leaflet gives the following ten points on the subject that summarize the practices employed in successful business:

1. Relieving the salesman of all possible clerical work.
2. Giving the salesman adequate information of past requirements of customers.
3. Carefully routing the work of salesmen.
4. Reducing the size of territories so that they can be covered economically.
5. Training the salesman to give quick demonstrations and concise selling talks.
6. The use of the advance notice card wherever advantageous.
7. Endeavoring to have a customer set aside a definite time for the salesman.
8. Making the call effective when the customer is out or busy, by giving a demonstration, rendering some service or securing credit information.
9. The use of the automobile for small town work.
10. Always stressing the element of service.

Regarding the saving of the salesman's time on clerical work, these statements of a large manufacturer and distributor are given in the leaflet:—

"In two of our twenty-five selling districts, we have made up lists of prospective customers, and arranged them both by classes of trades and geographical locations, and we have increased the district manager's clerical force so that the clerical work of the salesman may be reduced to a minimum. Furthermore, the salesman's work is carefully planned out in advance of its execution.

MUCH WORK DONE FOR THE SALESMAN

"We have found that lack of information about the prospective customers and what occurred in previous calls means a certain amount of time wasted in getting the lay of the land in every call, to say nothing of the more intelligent reports that can be made when the salesman has the complete story of the prospect before calling. Under this plan the salesman is furnished record cards plainly and neatly filled out, showing sales, lost orders, items bought, date that prospect will be in the market, and any other information of value taken from report slips of previous calls. A glance at the card brings the salesman up-to-date, while practically ten minutes or so of conversation would be required under ordinary circumstances."

As to the relation between the number of calls and service, this is said:—

"The number of calls should not interfere with the quality of service rendered, for the idea is gaining hold that manufacturers and merchants in the last analysis are not selling products but rendering service. This note is expressed in the two quotations following:—

" 'We feel that the element of service is more important than operating under a time clock. We encourage our men to arrange, wherever possible, to serve their customers at the latter's convenience, and sometimes this may be the early morning or at the later afternoon period. Many of our men have successfully utilized their time when it was necessary to wait, because the dealer was occupied, by aiding him in the sale of his merchandise and by giving other assistance to the dealer. In this way he has not only formed a good impression, but likewise has reduced the loss of time which might occur through waiting for an opportunity to have an interview.

" 'Our salesmen are service men, whom we endeavor to train and equip in such manner that they are able to make an appreciable contribution toward the solving of the questions and needs of the customer. They are constantly confronted by problems of distribution, merchandising, advertising and even financing, and local conditions are largely responsible for the existence of such problems, and govern too the time necessary for a practical solution.' "

Wanted—A Museum of Machine Tools—Discussion

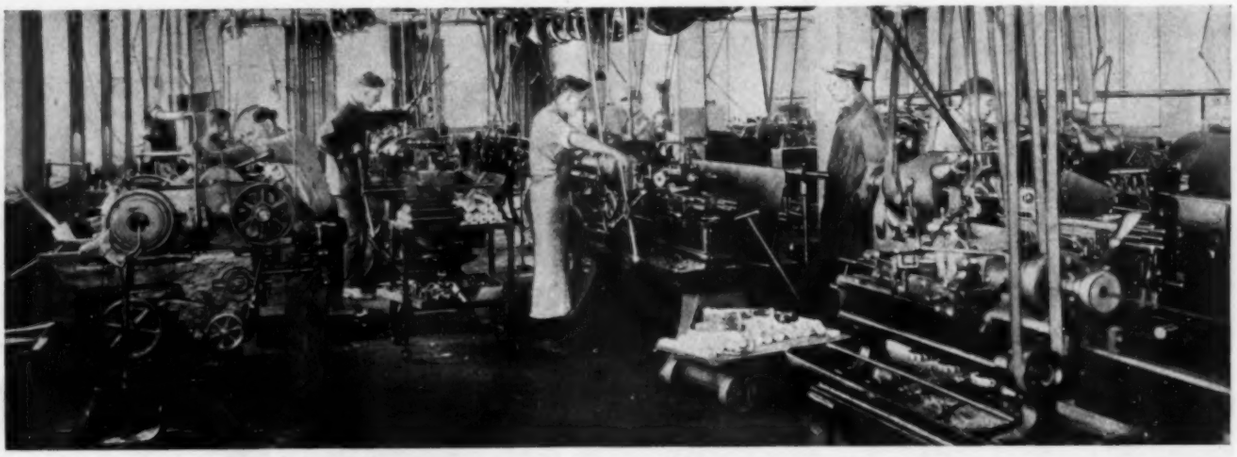
BY L. L. THWING

Referring to the article by Harry E. Harris under the title given above on page 689, Vol. 59 of the *American Machinist*, we cannot expect everyone to enthuse over our own particular hobby, be it collecting Beadle's dime novels or door knobs from famous buildings, so we should sympathize with Mr. Harris if he cannot "conceive what value such a collection (of old machine tools) would have, except to please a collector's whim, or satisfy the idle curiosity of a few."

To the writer, the interest which a large number of people take in tablets bearing the inscription "This is the spot where ————," seems profitless; and there are those who believe that golf is a game that unnecessarily prolongs the lives of some of our most useless citizens. But it seems presumptive to attempt to curtail the pleasure of those whose tastes differ from our own.

The question of the value of any sort of an entertainment, be it educational or otherwise, is too large a question to discuss here, but it is a fact that a large number of people do find pleasure in various collections of all kinds, such as are found in the museums in our large cities. In the new National Museum is a collection arranged to show the development of the drill from the flint implement of the savage to the high-speed twist drill of today. Just what the value of such an exhibit is, would be hard to put in words, but it interests a certain percentage of the masculine population and educates them in the history of the progress in the art of drill making. What the value of an education in ancient methods or ancient history is, I will leave for someone else to answer. Considerable time is given to the latter, and it may be wasted.

There is one thing that is certain, viz.: that museums and collections do not get themselves assembled without considerable effort on the part of a large number of interested people, so that if the writer's interest in old machine tools is not shared by many other people, there will never be much money spent for a museum of machine tools. In fact, even if there is a considerable amount of general interest in such a movement, it will never get anywhere unless it is pushed. That is why a committee was appointed by the Associated Engineering Societies, and it is on this assumption that it is thought that such a museum would be enjoyed by enough people to justify its existence.



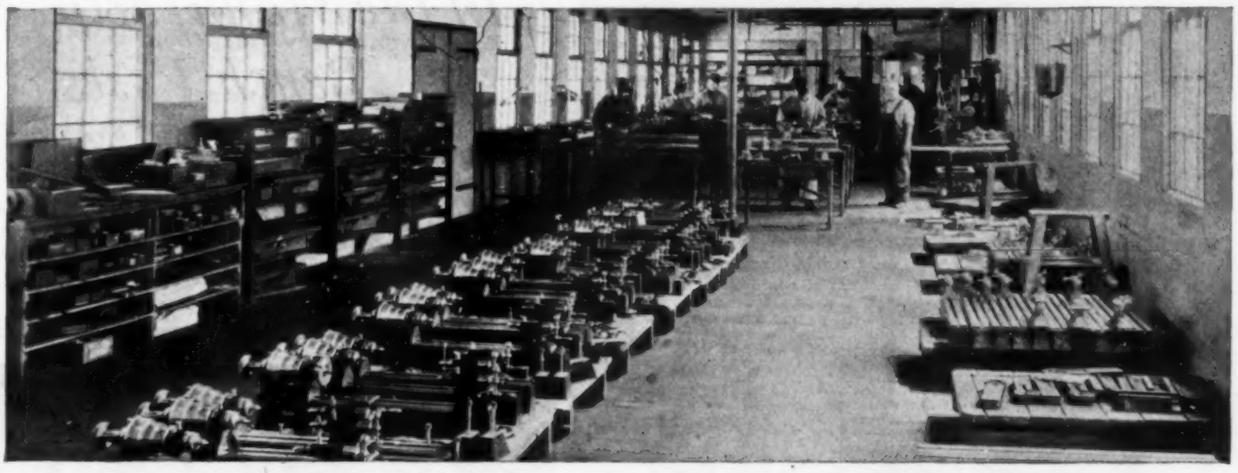
Making Parts on Turret Lathes and Automatic Screw Machines

Where Machine Tools Are Made

Rivett Lathe & Grinder Corporation

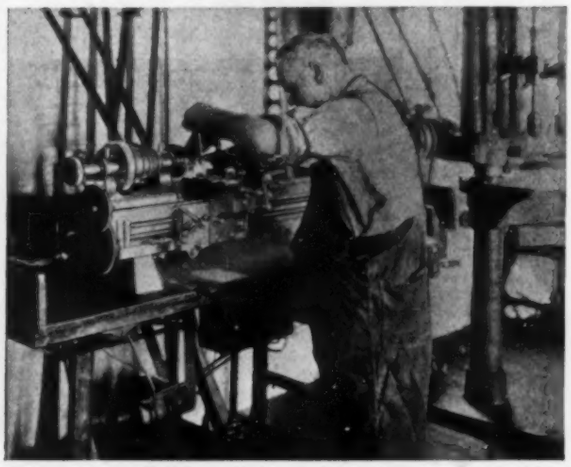
Founded 1884

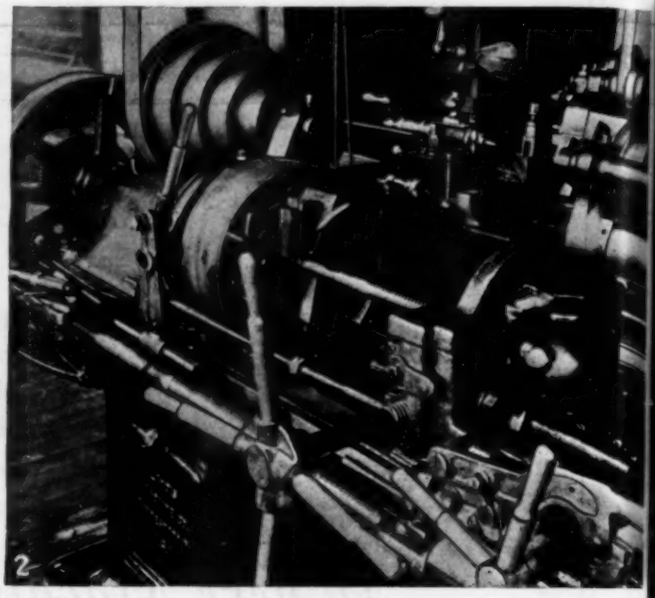
In the Assembly Department



Scraping to Surface Plates and Gages

The Final Testing

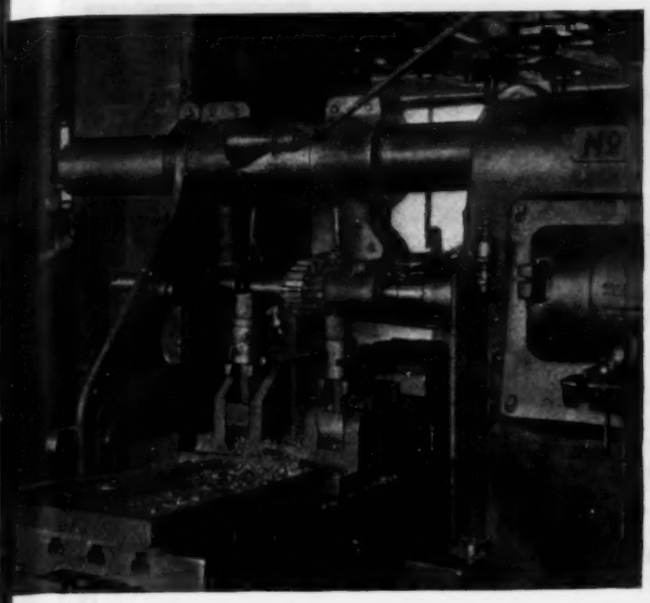




Steps in the Manufacture of Bench Vises

Athol Machine & Foundry Co.

Athol, Mass.



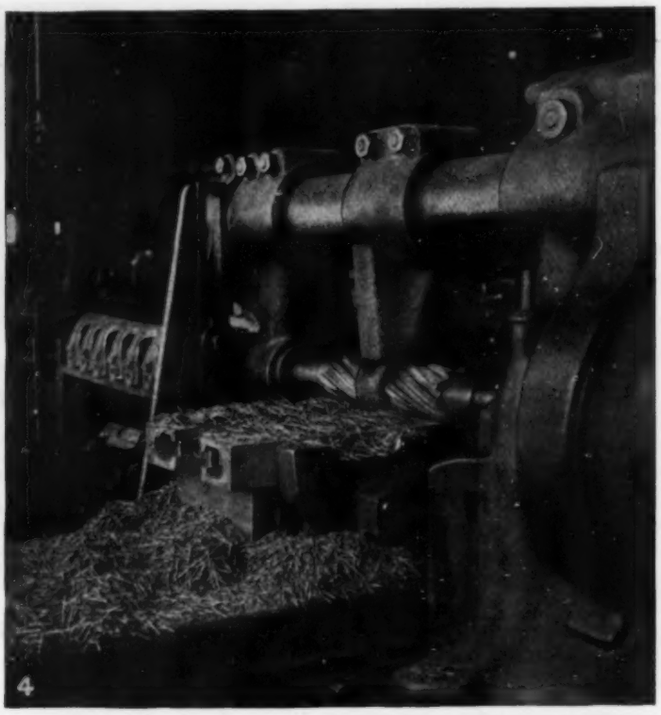
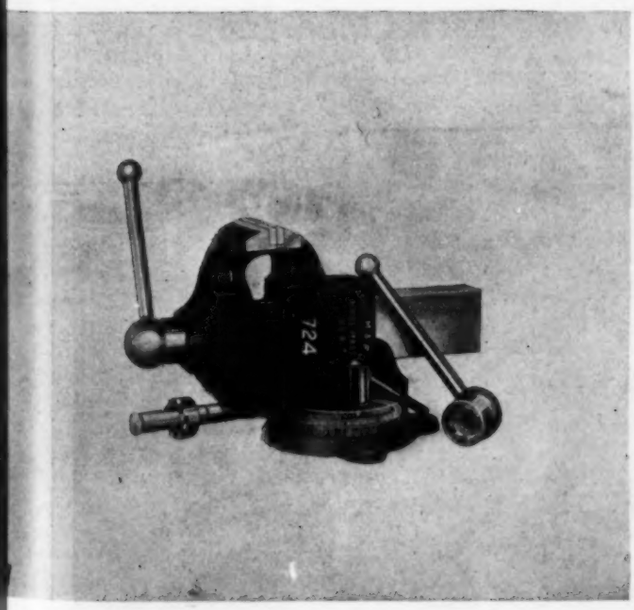
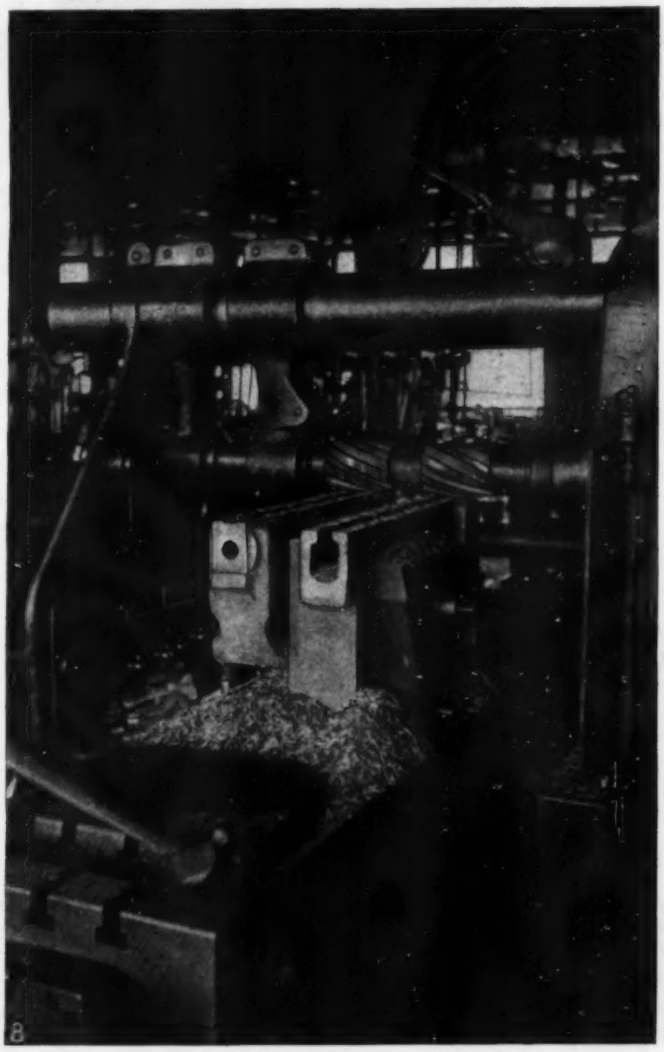


Fig. 1.—Milling Small Vise Beams in Cincinnati Semi-Automatic Machine
Fig. 2—Threading Vise Screws on Landis Bolt Cutter
Fig. 3—Milling Vise Jaws on Cincinnati Machine
Fig. 4—Milling Sides of Vise Beams on Cincinnati Machine
Fig. 5—Broaching Square Hole for Beam in Lapointe Machine
Fig. 6—Making Screws for Small Vises on the Gridley Automatic
Fig. 7—One of the Vises
Fig. 8—Milling Under Sides of Beams in No. 3 Cincinnati Machine





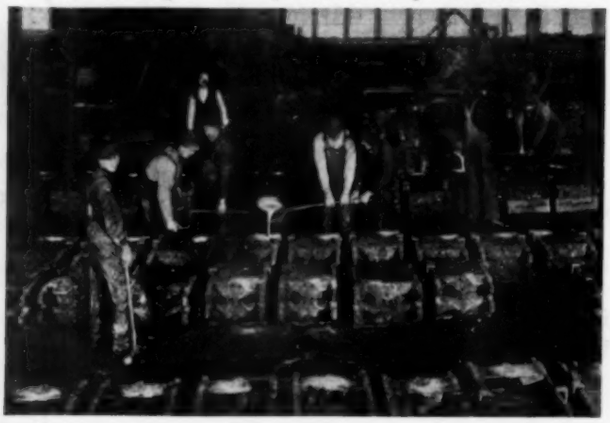
Airplane view of plant

Where Big Pulley Blocks Are Made

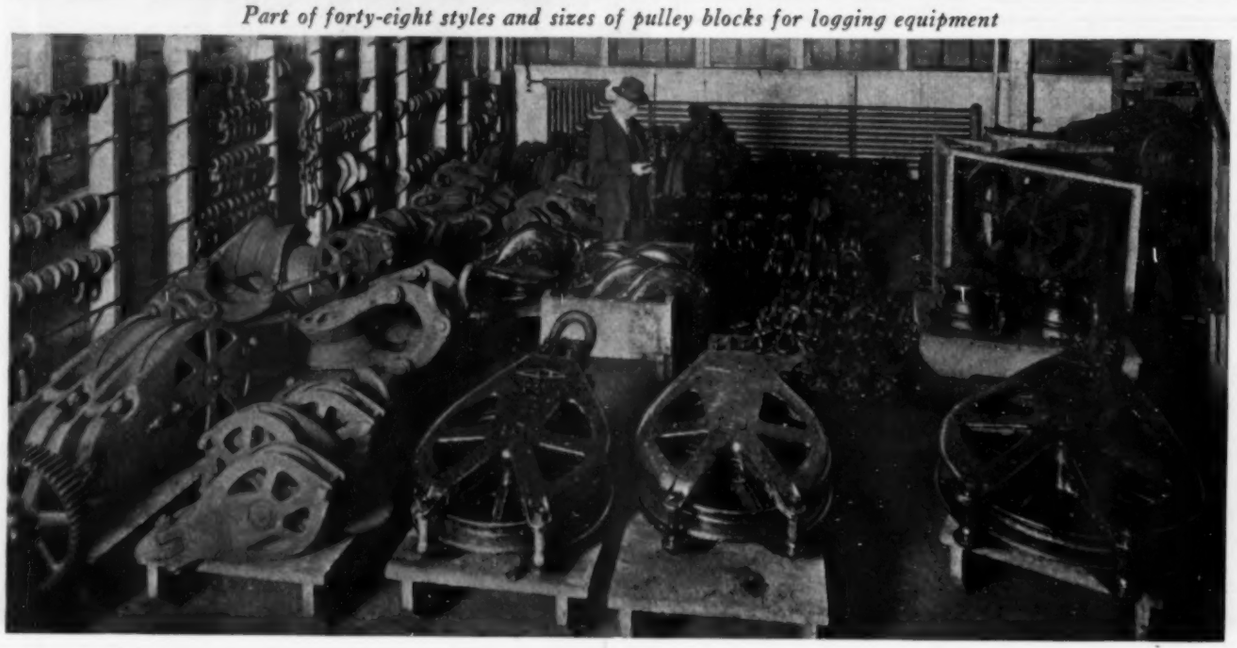
Lamb Machine Co., Hoquiam, Washington

Using Greene electric furnace in pouring vanadium alloy steel for block side-castings

Pouring with small shank ladles. This method has been superseded by the bottom-pour ladle



Part of forty-eight styles and sizes of pulley blocks for logging equipment



Book Reviews

Commerce Yearbook. 1922. (Including early part of 1923.) Compiled under the direction of the Bureau of Foreign and Domestic Commerce. Julius Klein, Director. 692 pages, 6x9 in., clothboard covers. Sold by the Superintendent of Documents, Government Printing Office, Washington, D. C. Price, 60 cents.

This unique volume is the first issue of a yearbook which is to be published annually, hereafter, by the Department of Commerce. The present issue covers the year 1922 and its publication was delayed by the difficulties attendant upon the compilation of the material for a book, so wide in scope and detailed in character. Before the volume was ready for publication it was found possible to cover the early part of 1923 also, and this has been done.

As stated in Director Klein's letter of submittal to Secretary Hoover, the book is published not only to meet the need for a reference source, but for a book which can be read for general commercial information and for a survey of the most important economic developments of the year.

In a review of the period covered, the trend of business in general is noted, the effect of the depression of 1921 is shown, and a summary of the conditions and developments in various great industrial groups is made, together with discussions of such subjects as prices, employment and wages, transportation and communication, banking and finance, foreign trade, and balance of trade. These review pages form an excellent introduction to the book, as they give the reader a broad picture of the industrial and economic developments practically throughout the world for 1922 and the spring of 1923, and make it easier to study intelligently detailed information which follows.

Production of manufactured goods increased during 1922 by about 20 per cent over the figure for 1921, and this revival of production is made the basis for a study of causes and effects in the next section of the book. This matter is, of course, largely statistical but is presented in such a way and so clearly explained that it is instructive and interesting.

Individual industries are next studied and it is impossible in a few words to give an idea of the wealth of information and valuable statistical comparisons contained in this section of the book. The treatment of the machinery industry may be used as an example, although each industry is discussed in the way best calculated to bring out the salient points.

A summary of developments in this industry for the period is followed by remarks on the general scope and position or rank of the industry and the rank of the United States among other countries. Production conditions before 1922 and the recovery from the depression are then discussed, the points made being emphasized by the accompanying statistical tables and graphs. This is followed by an exposition of foreign trade movements in the machinery and machine tool industry.

Detailed discussions of finance and banking and foreign trade are followed by a comprehensive economic review of all foreign countries with which trade was carried on. This section is particularly illuminating and valuable.

The book should fulfil the requirements which made its publication a matter of need and gathers in one volume an amount and variety of commercial information never available in this form.

The Design of Diagrams for Engineering Formulas and the Theory of Nomography. By Laurence I. Hewes, deputy chief engineer, U. S. Bureau of Public Roads, and Herbert L. Seward, associate professor of Mechanical Engineering, Sheffield Scientific School, Yale University. First edition, 111 pages, 83 illustrations, 9x12 in., clothboard covers. Published by the McGraw-Hill Book Co., 370 Seventh Ave., New York, N. Y. Price, $5.

Because this book is a bit unusual and aims at performing a valuable function in engineering work, it merits special attention. This is particularly true because of the increasing importance and prevalence of diagrammatic solutions for engineering formulas. All too often such diagrams are made by the method of trial, which naturally is not conducive to the best results nor saving of time.

The book presents the theory underlying nomography, or the diagrammatic representation of formulas, which enables the positions of the various elements of the diagram, the limits of accuracy, and the range of values of the variables to be accurately planned in advance. Trials can thus be dispensed with in the actual construction and a permanent, useful diagram results, giving a saving of time in the construction. The chief saving, however, is in the use of the diagram when solving a formula, as it ordinarily requires but a fraction of the time taken for direct computation by means of the formula. If the formula is difficult of solution and need be solved often, the advantage is evident.

The subject matter of the book has been well tested out by teaching of the subject at the Sheffield Scientific School. It is the aim of the writer not merely to outline the methods of drawing diagrams but to develop the grasp of the reader on the subject so that he will be able to analyze complex formulas. Since the author believes that the treatment would be handicapped by attempting to avoid the use of the third-order determinants, that notation is employed in the latter part of the book. For those not familiar with this branch of college algebra Appendix A presents sufficient treatment for the work in hand. The use of "projective transformation" is mentioned, but the reader must not necessarily understand it. Appendix B, however, gives a simple treatment of the subject.

The determinant notation helps greatly to identify the given formula with a known type. This identification has, furthermore, been made more complete by the introduction of an entirely new class of nomograms designated as "diagrams of adjustment." All other alignment diagrams are special cases of these more general types, as they may be considered as diagrams of adjustment where the adjustment has reduced to zero.

So that a variety of types of formulas can be explained, fifty-four illustrative examples have been worked out. Most of the diagrams appear in large size, which the format of the book readily permits. The problems at the end of each chapter can be of use to both student and instructor. The treatment of the subject is quite concise, considering the range of material covered. As the steps are logically taken in the development, there should be no great trouble for the

student in following the ideas and in mastering the subject. The book should prove useful to engineers, designers and those who must frequently solve formulas.

Rehabilitated Ex-Service Men Candidates for Employment. 238 pages. Issued by the United States Veterans' Bureau, Washington, D. C.

This report is essentially a collection of tables showing the number of ex-service men undergoing rehabilitation instruction in the various districts. They are grouped by states with the idea that a manufacturer having openings for certain kinds of workers or minor executives would be most interested in men from his own district.

Further classification is by occupation. Under each state the table shows, for example, the number of mechanical engineers, machinists, gardeners, stenographers, etc., that will finish training each month from July, 1923, to January, 1924.

A similar report, prepared for the use of the United Steel Corporation, resulted in the satisfactory placement of a large number of rehabilitated veterans. Action indorsing the project has been taken by chambers of commerce, labor unions, and other bodies.

Several paragraphs from the general statement preceding the tables are worth quoting.

"Men with one arm are trained for work in which only one arm is brought into use. Men who have lost their sight or hearing are trained for work in which these senses are not absolutely necessary.

"The great majority of them are normal in appearance, normal in ability, and normal in their manly desire to be self-sustaining and to make a success of their lives, for the sake of themselves, their dependents, and their fellow men in general.

"More than 33,000 of these men have been rehabilitated and have gone into employment within the last two years. Statistical studies made on some 20,000 of them show that they are earning more in their new vocations than they earned before the war, and before they received their disabilities or handicaps from service in the army.

"It is the desire of the Government that employers take these men and pay them according to their individual earning power and accomplishment.

"The Government does not ask charity for these men. They do not ask charity for themselves. They deserve wise and sympathetic consideration and an opportunity in keeping with the best thought and the best feeling of our country."

Self-Taught Mechanical Drawing and Elementary Machine Design. Third Edition. By F. L. Sylvester, with additions by Erick Oberg and C. W. Reinhardt. Clothboard covers, 5x7¼ in., 345 pages, 237 illustrations. Published by The Norman W. Henley Publishing Co., 2 West 45th St., New York, N. Y. Price $2.50.

The volume is well written for, and should fulfill, the purpose implied in its title of helping the student or mechanic to acquire a knowledge of drafting and machine design. The treatment goes back to first principles, as the author wishes it to care for the needs of the student whose previous theoretical knowledge is limited. Self-study is aided by clear, sufficient, but concise treatment of important points, and sufficient explanation of fundamentals.

Mechanical drawing is the first subject treated, followed by the methematics necessary for the solution of problems in machine design. Elementary mechanics and strength of materials then come in for consideration. Lastly, chapters are devoted to the design of the various elements and details that enter into machine design, such as cams, gears, shafts, screws, clutches and flywheels. The book closes with some practical instructions for mechanical drawing and lettering.

The volume is thoroughly practical and should prove of real value to those for whom it is intended. It should be commended for aiding the practical mechanic and young draftsman to advance in knowledge of the art.

Magnesium. 177 pages, 4½x7 in. Published by the American Magnesium Corp., Niagara Falls, N. Y. Price $2.50.

This is a very complete little handbook of information and data relating to the use of magnesium and magnesium alloy. It is intended to meet the growing demand for information concerning this relatively new metal, which is being used more and more in the automotive and other industries. The book seems to contain about all the information that a prospective user might need and should prove a valuable addition to our literature on the subject of light alloys.

Teach Your Boy a Trade—Discussion

BY LAWRENCE F. SWENSON

There recently appeared on page 392, Vol. 59, of the *American Machinist*, an article under the title given above by W. J. Fisher, Jr., in which he points out the desirability of every boy learning a trade and wonders why the machinist trade is being neglected at the present time.

There are several important features about the machinist trade as it is being worked today that cause this condition. To my mind the prevailing wages have more to do with the situation than is generally believed. Another thing I have noticed is that many shops make little or no difference in the wages paid to men who are all-around machinists with an apprenticeship training and the ones who have been taught to operate only one or two machines.

When such conditions exist, it is not to be wondered at that young men of the desirable type go into the building trades to get the high wages offered, or into office work to be away from the dirt and longer hours, but paid fully as well as the average skilled machinist. Much of the old spirit of being able to do a good job is now lacking. Perhaps these conditions are unavoidable, but why should a young man choose a life work that will make him a human "cam" if he can possibly avoid it?

Mr. Fisher also thinks it regrettable that so few college men go into the machine shop. I think that a man with college education working as a machinist is misplaced, because of the few positions open to him for advancement. When a college man goes into one of the professions, he mingles with men who know more than he does which has a tendency to elevate him both morally and intellectually, whereas the average machine shop would have the reverse effect. Propaganda of the right sort is beneficial, but I fear it would not do the machinist trade much good as long as the present condition continues.

Modern Problems in Gear Testing and a Proposed Testing Machine

BY WILFRED LEWIS

The purpose of the proposed tests will be the determination of the effect of varying degrees of tooth accuracy and varying velocities on the strength of gear teeth. The information gained by this research will be essential to the solution of wear and noise problems, and further investigation along these lines will be undertaken.

The Special Research Committee on gears of the A. S. M. E. has made arrangements to have the tests made by the Massachusetts Institute of Technology, and is awaiting the receipt of sufficient funds to complete the building of the machine and beginning the tests.

ABOUT thirty years ago, the writer made an investigation of the strength of gear teeth based upon tooth forms in common use, and formulated the working strength in terms of pitch, face, number of teeth and working stress. This investigation was theoretical rather than experimental in character and, in the application of the formulas developed, the engineer was expected to use his own judgment as to the safe working stress allowable in any given case. As a guide, however, to keep him within reasonable bounds, 8,000 lb. per sq.in. was suggested as a safe working limit for cast iron and 20,000 lb. per sq.in. for steel.

These stresses referred to static conditions or to gears running at slow speed without shock, and it was recognized that the safe working load was related in some way to the perfection attained in forming and spacing the teeth, and to the speed. However, no attempt was made to establish these relations, and the matter was left for future determination, after citing Walker's rules, published in 1868, as the best to be found on the subject.

How Walker's speed factors were obtained does not appear, but it is fair to assume that they were determined with considerable care from observations or experiments, and it is interesting to note their agreement in form with the results obtained by Professor Marx in his elaborate and carefully made experiments, reported to the A.S.M.E. in 1912 and 1915, as shown in Fig. 1. Both curves of strength are convex to the base line and approach it as asymptotes with the increasing speed.

It is difficult, however, to reconcile these results with the analytical work of Oscar Lasché of Berlin, published in 1899, which appears to have escaped the attention it deserved until translated and emphasized by Daniel Adamson in 1916. While recognizing the importance of the part played by resilience in iron and steel and the somewhat plastic deformations in such materials as rawhide and hard wood to absorb shock and reduce the increment load arising from irregularities in forming and spacing the teeth, he pointed to the tremendous influence of velocity on the detrimental effects of errors in pitch or form, and showed that rigid forms in rolling contact would cause increment loads proportional to the square of the speed.

From this point of view the curve of strength as affected by speed becomes a parabola focused in the axis of ordinates, and such a curve, also shown in Fig. 1, can be made to run very close to the extreme values as plotted for Walker and Marx. Instead, however, of dropping rapidly at first and showing smaller losses thereafter for equal gains in speed, the Lasché curve of strength has an entirely different character, being a curve wholly concave to the base line and plunging across it in a way which would seem to put a definite limit to the speed.

On the other hand, it is pretty clear that if gear teeth were perfectly formed and spaced, there would be no appreciable loss in strength from speed, and yet thirty years ago the writer was rash enough to presume that

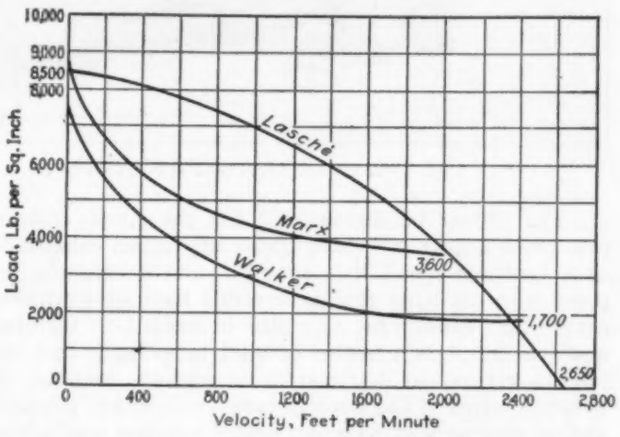


FIG. 1—CURVES SHOWING RELATION OF ALLOWABLE LOAD ON SPUR GEAR TEETH TO VELOCITY

there might be a difference of two to one, representing the usual difference between a live load and a dead load. That was before the advent of automobiles with their highly elastic pneumatic tires, which show on a smooth road a uniform elastic compression quite independent of speed, and make clear the difference between a suddenly applied load and one that is simply transferred, as it might be in perfect gearing from one tooth to another, without shock.

A comparison of the curves of strength as plotted for Walker and Marx shows a gain of 12½ per cent in the static strength and 100 per cent in the running strength at 2,000 ft. per min. The initial gain may be due to better material and the gain at speed to the better forming and spacing that has come about in fifty years of evolution in the art of gear cutting. Walker's gears may have had cast teeth laid out by old-fashioned approximate methods, and if cut teeth were used, the

A paper read before the American Gear Manufacturers Association, Cleveland, Ohio, April 20, 1923.

same cutter was probably made to answer for more than one pinion and for wider ranges in larger gears. Generated gear teeth were then unknown and it is not surprising that the results obtained by Marx are so much higher than those given by Walker so many years ago, but in view of the wide divergence between these results and those indicated for momentum, the question may well be asked how they can be reconciled with each other, and the answer seems to call for further investigation in the hope that a new gear testing machine may shed some light upon it.

In the writer's opinion, breaking tests are misleading and should be discouraged for the simple reason that when a gear is broken under any given conditions as to load and speed, it is done for, and it becomes impossible to say what that gear would have shown under some other conditions. So also in regard to forming and spacing, it is a matter of vital importance that the minute errors, so detrimental to smooth running, be noted in terms of the velocity ratios which they produce, and as near as may be under actual working conditions.

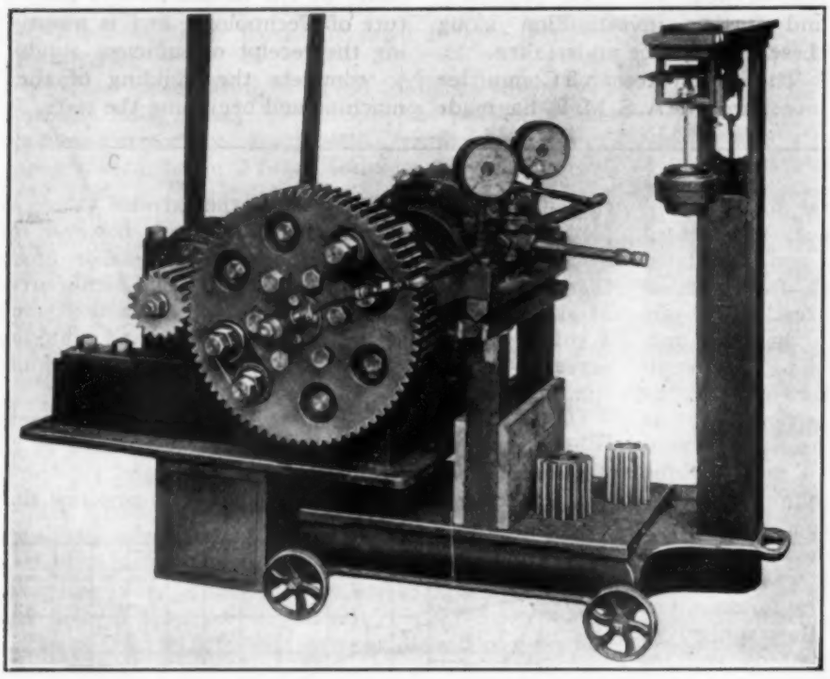


FIG. 2—A GEAR TESTING MACHINE BUILT IN 1916

But if it be true, and no doubt it is, that errors in forming and spacing are responsible for the loss of working strength in gear teeth at speed and that, as pointed out by Lasché, the variations in velocity ratios caused thereby give increment loads proportional to the square of the speed for rigid forms in continuous rolling contact, a complete understanding of the effect of speed upon the strength of gear teeth requires a correlation of errors to the increment load or to the permissible speed, as indicated by Adamson in the paper referred to above.

Originally, the writer believed that the only way to ascertain the effect of speed upon strength was to run gears to destruction on the lines followed by Professor Marx, and in view of the difficulties attending the use of power sufficient to break heavy gears at high speeds, he was tempted to design the gear testing machine described in the *Transactions* of the A.S.M.E. for 1914, afterward built for the University of Illinois in 1916, and shown in Fig. 2. This was also intended to determine the efficiency and breaking strength of gear teeth under various loads and speeds, but the war intervened and nothing has as yet been reported from its use.

Here again the principle announced by Lasché was overlooked, and it was not until the summer of 1920 that the writer's interest was revived by a communication from Charles H. Logue, the first step forward in the application of Lasché's principle since its importance was emphasized by Adamson in 1916.

Mr. Logue proposed the making of mechanical diagrams to show in a magnified way the irregularities in velocity ratio for a pair of engaging gears, and from these diagrams to calculate the force of acceleration causing an increment load which, when deducted from the allowable static load, would give the allowable safe load at any speed.

For this purpose, a pair of gears were mounted in bearings, and a pair of disks on the gear shafts were connected by a wire, the tension in which caused pressure between the gear teeth. The disks, of course, bore the same relation to each other as the pitch circles of the gears and, as they turned with the teeth in action, irregularities in velocity ratio would cause more or less slack in the connecting wire, which was multiplied by an index finger. Readings were taken at successive points in the arc of action and the variations in velocity were noted as the data needed in connection with mass to determine the increment load at any speed. This apparatus was modified and improved to give indicator diagrams on paper ribbons, or on disks in a closed curve, from which the increment load was calculated and, at the suggestion of Mr. Adamson, Mr. Logue very freely laid the whole matter before the writer to discover if possible whether the gear testing machine above referred to could be utilized in connection with his problem.

So far as the diagrams were concerned, the testing machine was seen at once to be admirably adapted to their accurate production under conditions that could not be realized so well with any other form of apparatus, but it took some time to observe that the same machine was equally available for the direct determination of decrement loads rather than increment loads, and that it might be materially simplified without detriment, as a means for determining the effect of speed upon the strength of gear teeth.

The development and construction of such a machine was suggested by the writer to the General Research Committee of the A.S.M.E. about two years ago, as a promising source of information on the effect of speed upon the strength of gear teeth, and this suggestion led to the appointment of a Special Committee of Research on Gears, consisting of Earle Buckingham, Ralph E. Flanders, Arthur M. Greene, Jr., Chas. H. Logue, F. E. McMullen, E. W. Miller, and the writer as chairman, to which committee Ernest Wildhaber has since been added. To the helpful, constructive criticism of these experts, and others who have kindly volunteered suggestions, the gear testing machine in its present form

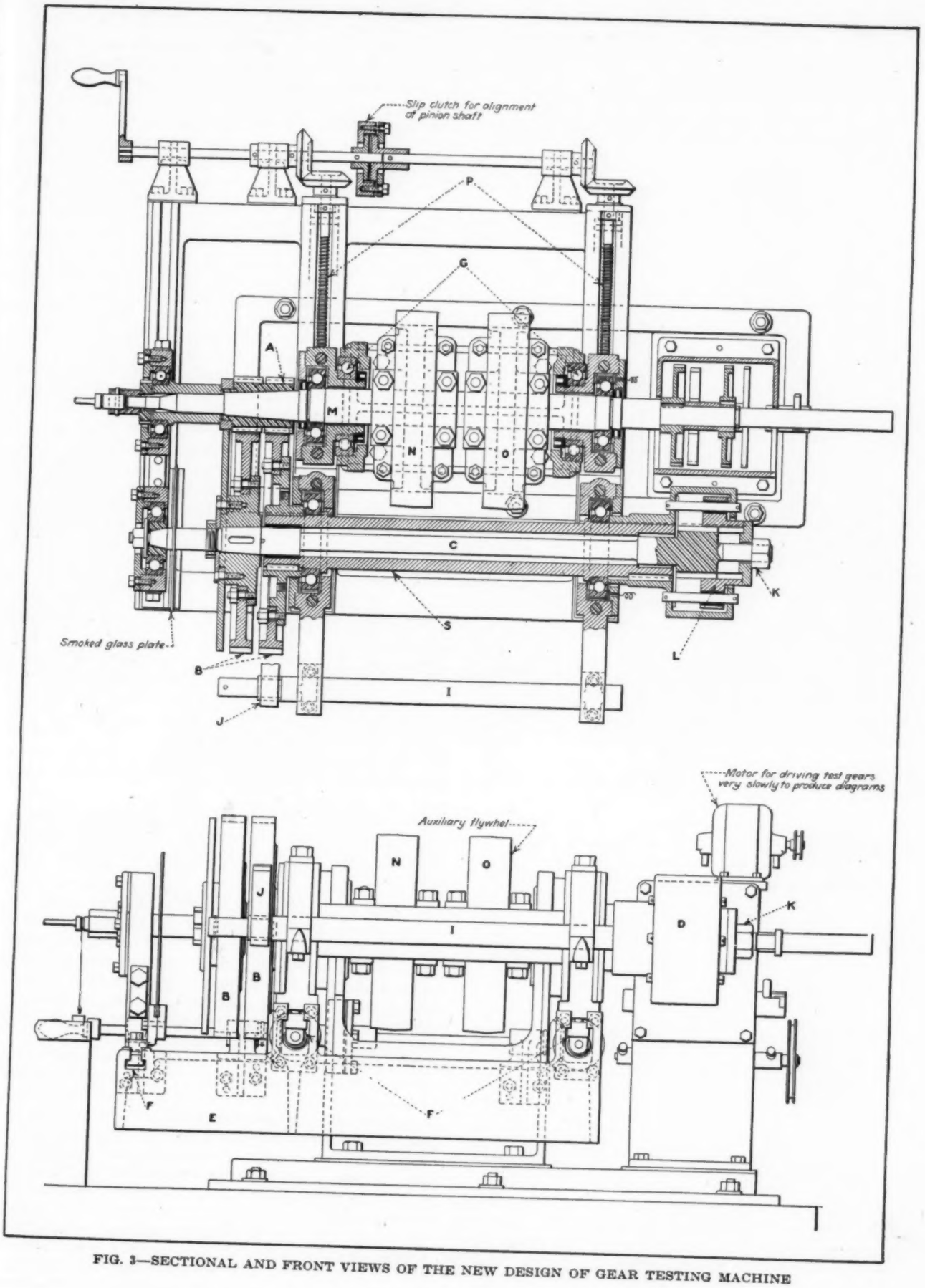


FIG. 3—SECTIONAL AND FRONT VIEWS OF THE NEW DESIGN OF GEAR TESTING MACHINE

is due and, as the result of an appropriation by the A.S.M.E., the writer has been enabled to make general and detail drawings, on which estimates are being asked for the construction of the machine.

Referring to Fig. 3, the new gear testing machine is shown to consist, as before, of a wide faced pinion *A* mounted in bearings on a swing frame which carries a pair of test gears *B* on telescoped shafts, *C* and *S*, the outer ends of which can be twisted to produce an initial load and held in place by a powerful screw adjustment *D*. This differs from the machine described at the Annual Meeting of the A.S.M.E. in December, 1922, by the addition of outer bearings suggested to Mr. Flanders by Professor Magruder of the Ohio State University, and they constitute a very important improvement in the machine. The swing frame is extended as an anchorage for these bearings and it now consists of a cross ribbed casting *E* with three parallel slots *F*, two of which carry the main bearings and one the outer bearings, all of which are securely clamped in position before the initial load is applied.

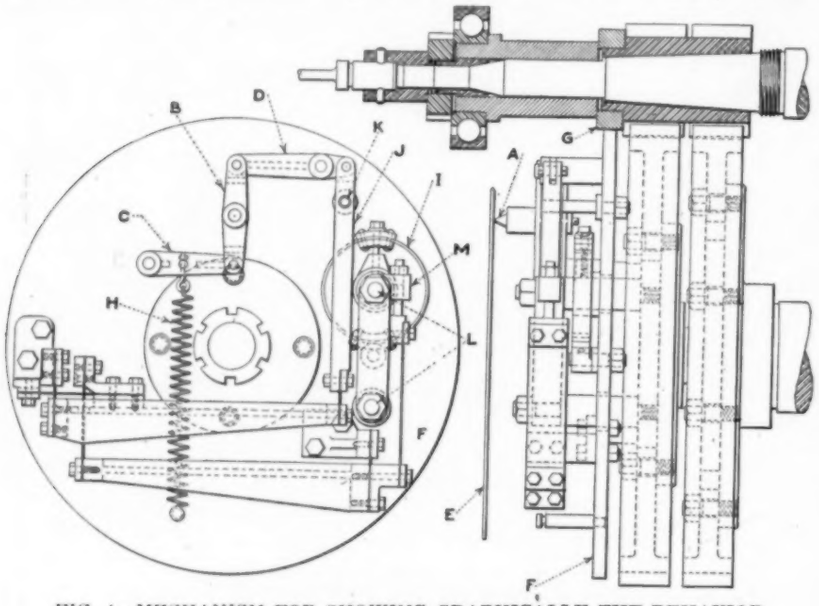


FIG. 4—MECHANISM FOR SHOWING GRAPHICALLY THE BEHAVIOR OF GEARS UNDER TEST

The swing frame is carried on two Hess-Bright bearings *G*, with 1-in. balls, in a fixed stand *H* centered on the pinion shaft. Parallel with this shaft and at a convenient distance, determined by the sizes of the engaging gears, is a heavy round bar *I* resting upon portable platform scales. A pawl *J* on the projecting end of this bar can be engaged with either or both of the test gears, and when so engaged the initial load can be adjusted by a nut *K* on the outer end of the central shaft through an intervening nut *L* of very long pitch, mounted on the same shaft and engaging the telescopic sleeve by insulated pin connections. When an initial load has been applied in this way, it can be accurately measured by the supporting scales, as will appear later on. In this way the load on the teeth is made to act equally in opposite directions upon the wide-faced pinion, but when running, there will be a slight difference in pressure on the test gears which measures the friction loss as shown by the scale readings.

The pinion shaft *M*, 3 in. in diam., is carried on three Hess-Bright ball bearings with $\frac{11}{16}$-in. balls, and the driving pinion runs between two of these, pinched on a conical surface to avoid the use of keys and to make changes easy. The pinion shaft may be driven by one of two heavy belt pulleys, *N* and *O*, which serve also as flywheels, or by a motor coupled directly to the end of the shaft.

These flywheels are made in halves to be clamped securely to the pinion shaft, which may be run with either, both, or neither of them. The pinion shaft alone, with an 18-tooth pinion, is estimated roughly to have a mass effect at its pitch line equal to that of either test gear of 72 teeth running with it. This mass is augmented about 25 times in each of the flywheels provided so that the effective mass of the pinion shaft with both flywheels attached is about 51 times that of either test gear.

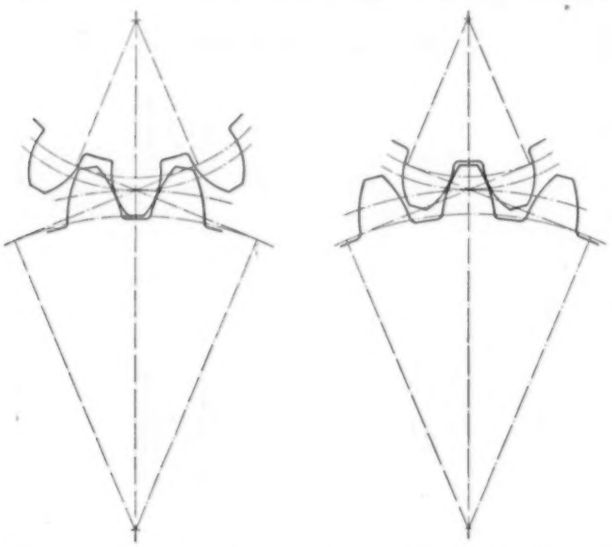


FIG. 5—POSITIONS OF MESHING GEARS IN WHICH THE LINES OF ACTION INTERSECT AT THE PITCH POINT

Test Gear Mounting

The sleeve *S*, on which one of the test gears is mounted, is carried on 1-in. balls in bearings dowelled to the swing frame, and the other test gear is carried on the end of the central shaft *C*, between an outer bearing on $\frac{11}{16}$-in. balls and insulated bearings in the sleeve. All bearings are insulated to provide for electrical connections, as will presently be explained.

When the pinion shaft bearings are loosened on the swing frame, the frame, with the fixed bearings, can be traversed to any desired center distance by the lead screws *P*, and distance pieces set between the bearings will insure perfect alignment. To guard against irregularities in pitch or adjustment of the lead screws, a slip joint is introduced in the bevel gear shaft, and by this means the screws can be turned together or independently, as desired.

It is evident that if the engaging teeth are perfectly formed and spaced, the gear wheels will run side by side in unison. If imperfections exist, they will cause the test gears to shift relative to each other, thus gain-

ing and losing in speed and causing increments and decrements in the load carried on the teeth.

It occurred to the writer, therefore, after seeing the results obtained by Mr. Logue, that this shifting of the test gears could be made visible by suitable multiplying levers attached to them, as shown in Fig. 4, and actuating a scriber. To accomplish this result the scriber *A* is mounted in a link *B* between the radius arms *C* and *D*, so centered as to form a Watt parallel motion, and it is made to act, under light spring pressure against a plate of smoked glass or a photographic film *E*, by levers which multiply the differential movement about 250 times. Although Watt's parallel motion is not quite perfect, it will be seen that between the limits to which it is here applied, it is very simple, effective and accurate. Originally these levers were all mounted on pin bearings, half of which were subsequently changed to plate fulcrums at the suggestion of Major Buckingham, to whom we are also indebted for a very ingenious optical device for making diagrams at speed.

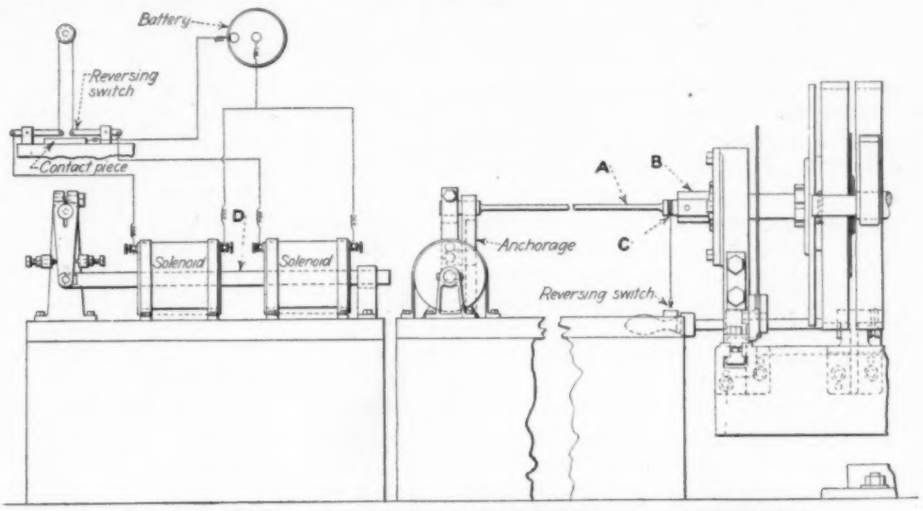


FIG. 6—ELECTRICAL TORSION ATTACHMENT USED TO DETERMINE RELATIVE ANGULAR MOMENTUM

The diagrams made by the mechanism of Fig. 4 require a very slow and steady rotation of the pinion shaft to avoid undesirable momentum in the multiplying levers, and this is produced, when desired, by a small motor carried on the gear cover at the end of the pinion shaft, Fig. 3. This motor is belted to a light shaft beneath, which is connected through a chain of reduction gears to the heavy pinion shaft. This train of gearing and all parts used in tracing a diagram are, of course, disconnected when the test gears are run at speed.

If there were no irregularities in the gears, the scriber would trace a perfect circle but, since absolute perfection is unattainable, the scriber will move in and out as it turns with the test gears, and trace a line indicative of acceleration or retardation which, when interpreted with reference to the conditions imposed, will give the increment or decrement in the load carried on the teeth.

The radial movement of the scriber will show the plus and minus displacements of either test gear as measured by the constant velocity ratio of the rolling disks, *F* and *G*, whose diameters are equal to the pitch diameters of the gears and pinion. The smaller disk *G* is driven tight on the pinion and the larger disk or fulcrum plate *F*, which carries the multiplying levers, is mounted loosely on the hub of the outer test gear and is covered by a washer which holds it in place.

It will be seen that either test gear can be connected with the multiplying levers. A light helical spring *H* is attached to a stud in the fulcrum plate and carried to an arm of the Watt linkage to eliminate lost motion and produce an initial load upon all of the links and levers employed. The force exerted by this spring is amplified about 125 times by the levers through which it passes, until it comes to the anchorage *M*, and this considerable force, if unbalanced, would tend to slip the friction disks upon each other. A heavy counterbalance spring has, therefore, been introduced in the form of a ring *I* between the anchor post and a pin in the large friction disk, the reaction of which balances the tension upon the tape connecting the multiplying levers with their anchorage.

One of the links in the system, *J*, is made large and heavy to allow for drilling to a perfect balance, and the same link is drilled to form a clearance hole for a stop pin *K* in the friction disk. In this way the movement of the stylus is limited to an amount that will safeguard the flexible fulcrum plates between the multiplying levers, while providing ample movement for the stylus under any anticipated conditions. An adjustment is provided at the anchorage to keep the limit stop clear of the link which circumscribes it, while making diagrams.

The anchor posts *L*, attached to either test gear, are made double like columns in an office building, and with a tie bar at their outer ends, thus giving the great rigidity required to show the minute displacements between the friction disk and the test gear to which it is attached. As proposed by Major Buckingham, one pair of test gears may be perfected by grinding, with which a pair of commercial gears can be compared and, for such comparison, provision has been made to positively secure the outer test gear to the fulcrum disk while making diagrams. The construction shown provides,

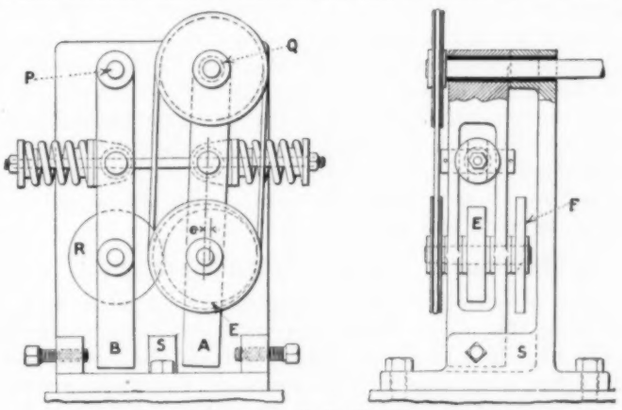


FIG. 7—A MECHANISM FOR FINDING ABSOLUTE INCREMENT LOADS

therefore, for diagrams of the velocity ratios between the teeth of each pair of gears and rolling disks, and also these variations combined.

When similar commercial gears are combined in one diagram, there are, presumably, two positions of the engaging gears and pinion, as shown in Fig. 5, in which their lines of action intersect the line of centers at the pitch point. There are also at least two other positions where their lines of action intersect each other on the line of centers above or below the pitch point, and in these four positions, or more perhaps, for every pitch traversed the test gears are in unison and the stylus is describing a circular arc, or a curve of inflection tangential thereto. The friction disks may or may not be used

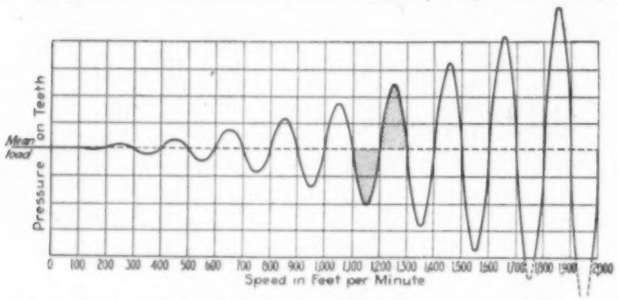


FIG. 8—DIAGRAM SHOWING PRESSURE ON GEAR TEETH AS AFFECTED BY MOMENTUM AT SPEED

in making diagrams, but in any case, there is nothing in the mechanism employed to slip or stretch; it takes no part of the load carried; and it is therefore possible to produce diagrams under light or heavy loads. A comparison of these diagrams may reveal the effects of compression and elastic deformations and tend to modify the law of the speed squared, which applies only to rigid solids.

However this may be, the results hitherto obtained come from the consideration and manipulation of very minute quantities, the multiplication of which may also multiply unsuspected errors in construction, and after seeking in vain for some way to measure the increment load direct, the writer began to consider the decrements entailed by increments, as pointed out by Mr. Logue. Then came the conclusion that when the initial load disappeared and caused the engaging teeth to break contact, there would be a distinct change in the noise, after which he hit upon the better plan of insulating the gears and using an electric circuit to announce through telephone receivers a break in contact with the pinion by either or both test gears.

Electrical Connection for Telephones

One or more dry cells are connected by a wire, therefore, to the pinion shaft, through which the current passes to the gear wheels in contact and divides in two branches, returning through telephone receivers in each branch to the opposite pole of the battery. This scheme was submitted to an electrical expert whose advise was that the breaking of contact between the teeth would be announced in no uncertain way and that variations in pressure might also be expected to make a noticeable change in the sound of the running gears, and more recently, Professor Greene of the A.S.M.E. Committee has confirmed this assurance.

Having set up an initial load on the test gears by means of the torsion device at the end of the telescoped shafts, the exact amount of pressure on the teeth can be weighed on the scales under the swing frame by engaging the pawl on the crossbar with one of the gear wheels pulling on the belt or fly wheel until a sharp click in the telephone receiver announces a break in contact. The gain or loss of weight on the scales should then be noted and converted into the pressure on the teeth by a simple proportion, expressing the ratio betweent the radius of the swing frame at the crossbar to the radius of the pinion.

The locking pawl may now be disengaged and power applied to drive the pinion shaft at a gradually increasing speed, which will be indicated by a tachometer, located for convenience above the little motor on the gear box. At the same time, the telephone receivers are ready to announce a break in the circuit and when this occurs the speed is noted. Having passed the speed required to break contact, the power may be reduced and another observation taken when continuous contact is resumed. These observations when repeated for various initial loads, will establish the relation between speed and decrement loads, as affected by all the conditions which enter into the problem. When the law of speed squared is not sustained by experiments, it becomes evident that elasticity or a shock absorbing medium is making itself felt in the action of the running gears. It is hoped that a way may also be found to establish an electric circuit through contact with wood fibre or raw-hide pinions, as well as through cast iron or steel, and so subject non-metallic substances to the same speed tests But, while increments and decrements are necessary counterparts in the maintenance of the initial or average load, they are not necessarily of equal intensity because their durations may be different, and consequently the diagrams will help to establish the relation between increments and decrements in any given case.

Increment Load with Infinite Flywheel

Having determined in this way the increment load for any given speed, the result applies to the test gear when running with a pinion of much greater mass or flywheel effect, and it remains to be seen what this increment might become if the pinion were attached to a flywheel of infinite mass. The angular momentum of the pinion shaft with flywheels attached as shown in Fig. 3, compared with that of the test gears, is relatively much greater than that of the same shaft and flywheels with a larger pinion although the larger pinion naturally increases the angular momentum of the shaft and attachments to which it belongs. But, in view of the fact that the test gears are substantially equal in mass and flywheel effect and, running as they do, with a pinion whose pulley is a massive flywheel and under conditions that impose substantally equal, opposite and approximately simultaneous reactions upon the pinion, there is no reason to ascribe much if any variation to the movement of the pinion, which runs in consequence as though attached to a flywheel of infinite mass.

This may not be strictly true, but it is not far wrong for a small pinion, and to determine whether or not the pinion shaft suffers any appreciable fluctuations in speed, the auxiliary flywheel *O*, Fig. 3, made in halves, has been provided to make comparative tests. If the reactions of the test gears are equal, opposite and simultaneous, the addition of another flywheel will have no effect; but, if the extra flywheel has an appreciable effect upon the decrement load, it is possible to determine the maximum result attainable with a flywheel of infinite mass from the relative moments of momentum

as found for the pinion shaft with and without the extra flywheel.

In this connection, it is necessary to ascertain the angular momentum or mass effect at the pitch line of each test gear and its connections, in terms of the angular momentum of the pinion shaft complete, with and without its auxiliary flywheel. Referring to Fig. 6, attention is directed to the apparatus indicated somewhat diagrammatically as a torsion pndulum with solenoid escapement. A slender rod *A* of tempered steel about ⅜ in. in diameter and 5 or 6 ft. long is attached to the end of the pinion shaft *B* at one end and to an anchorage at the other, the anchorage having a slight rotary movement between adjustable stops. Pole pieces are carried by a light cord from a groove *C* in the torsion rod near the pinion shaft, and serve to reverse the effect of the solenoids upon a core *D* attached to the swinging arm at the anchorage. The movement of this arm at the beginning of each reversal augments the torsion in the rod and it can be adjusted to maintain any desired amplitude in the oscillations. By disengaging the pinion from the test gears its periods of oscillation with and without the auxiliary fly-wheel can be taken, and then, after taking periods with either or both test gears engaged, the data for the desired moments of momentum become known.

Method for Finding Relative Angular Momentums by Oscillation Periods

All that we need to obtain in this way is relative values, the absolute effects of momentum being determined from experimental data to which these relative values are applied. For instance, the test gears may be disconnected to find the time t in which the pinion shaft alone may oscillate. One or both flywheels may then be clamped on the pinion shaft and the time T taken, showing, perhaps, $\frac{T}{t} = 5$ for one flywheel, from which the angular momentum of the loaded shaft is seen to be $\left(\frac{T}{t}\right)^2 = 25$ times that of the unloaded shaft. Then, with either or both test gears engaged with the pinion, other periods of oscillation can be taken and other relations established, so that in this way index numbers for mass effects at the pitch line may be assigned to the pinion shaft, with one or two flywheels or without any flywheel, in terms of the mass effect of a test gear as the unit of comparison.

In the gear testing machine the pinion shaft with one or two flywheels and the test gears are co-operating to produce effects, by reason of their inertia, which partially or wholly neutralize each other in their reactions, whereas reactions would ordinarily be confined in practice to a pair of gears or a gear and pinion. To illustrate the reactions of rigid forms in rolling contact, attention is called to Fig. 7, showing a stand *S* on which two pendulums, *A* and *B*, are mounted with rollers, *E* and *R*, held together by a load spring. *B* hangs on the quill *Q*, through which a shaft is carried to the upper pulley, which is belted to the pulley of the eccentric roller *E*. A balance wheel *F* at the other end of the lower shaft completes the pendulum *A*, which is heavier than *B* by reason of its additional parts. Either *A* or *B* can be attached to the stand *S*, thereby becoming substantially earth-fast and immovable, and by locking *A* to *S*, the eccentric *E* can be run at a certain speed and the spring tension adjusted to break contact under an initial load *b*. Similarly, when *B* is locked to *S*, and the eccentric *E* is driven at the same speed, the rollers will break contact under an initial load *a*.

These loads, *a* and *b*, are called absolute increment loads because determined for *A* and *B* with reference to an infinite opposing mass. Moreover, *a* and *b* are respectively proportional to the angular momentums of *A* and *B* which may be represented by *A′* and *B′*. But when *A* and *B* are both free from *S*, the initial load *I* required to maintain contact becomes $I = \frac{ab}{a+b}$.

A diagram of these reactions can be applied to a pair of gears under constant load as shown in Fig. 8. At slow speed the pressure on the teeth is constant, but as the speed increases, it rises and falls as shown by the wave line, maintaining a constant mean. At any constant speed, the shaded areas above and below the mean line must be equal, whether caused by a rigid solid like the roller *E* or by elastic gear teeth under impact. With the eccentric roller the ordinates above and below the line, as well as the shaded areas, must be equal, and with gear teeth this may also be true although not necessarily so. The increment may exceed the decrement, and evidence as to whether it does or not must be looked for in the gear diagram.

Without venturing upon a mathematical analysis which may be deferred until some experimental data have been obtained, let me say that the auxiliary flywheel seems to solve the problem as to absolute decrement loads, and that the diagrams point the way for their conversion into increment loads. The diagrams will show the errors and the speed tests will show the corresponding effect upon strength, so that ultimately the errors will be correlated to the strength at speed without breaking anything, and with a clear understanding of cause and effect. The same apparatus can be used also in tests of efficiency and endurance and a fund of information can be obtained, based upon analysis and experiment. These considerations make the machine of general interest and justify its further development.

Effect of Tooth Irregularities on Noise Can Be Studied

It will be seen that the gear tester as planned offers an unusual opportunity to study the effect of irregularities in the teeth upon the noise produced in running, and since quietness in running has come to demand more and more attention by manufacturers to satisfy the cultivated taste of an exacting public, it is believed that this end can be attained by the study of irregularities, not only in their effect upon strength but also in their closely related effect upon noise. It will be seen also that the gear tester is well adapted to tests of endurance, requiring only about 2 per cent of the power transmitted and returned through the test gears, and making it possible to note the effect of wear as the tests proceed. By running very slowly under a test load, as provided for making diagrams, the friction of approach and recess may also be distinguished on the scales, and coefficients of friction may be established for different speeds.

In conclusion the writer wishes to acknowledge his indebtedness individually and collectively to his committee of experts, and to the American Society of Mechanical Engineers for its cordial and generous support in this pioneer work.

The Danger of Ultimatums—Discussion

BY JOHN T. SLOCOMB

I most heartily agree with the writer of the short editorial discussing the above subject on page 424, Vol. 59, of the *American Machinist*, and would like to give an illustration of how an ultimatum worked in one case in a machine shop.

John Smith was very busy and was having considerable trouble in getting satisfactory help. One morning he discovered that Bill Jones was not on the job. Now, while Bill may not have been the best man in the shop, still he was useful and certainly valuable at that particular time. The superintendent informed Smith that he had issued an ultimatum to Bill Jones and, as Bill had violated the conditions, Bill was no longer there.

It was like this: Bill had asked for a raise in wages and the ultimatum was, "If you ask again, you get through"—and Bill had asked.

Even the owners agreed that the superintendent was justified in firing Bill, and Smith wasted considerable time trying to explain to the owners that the real fault was not in firing the man but in issuing the ultimatum. Any man has a right to ask for a raise in wages as many times as he pleases, as far as I know, but if he becomes a nuisance at it, of course, it becomes the owner's privilege to get through with him. Such decisions can best be made when the time comes, and there is no necessity of giving notice in advance.

ULTIMATUM NEITHER TEACHES NOR DISCIPLINES

We, in machine shops, are not running kindergartens, teaching children ethics in regard to how to act toward their superior officers, as the most important subject. We might be trying to build good machinery, and the two schools might not hitch up well together. Anyway, there is no use in trying to teach a man anything by killing him, for in that case, he cannot make use of his education.

In this case, Bill went about a half mile away and found a better job at higher pay. All he learned by the incident was that Mr. Superintendent had something the matter in his upper story. Many incidents of this nature have made machine shops unattractive to men of a certain fiber and have gone a long way in making the personnel of shops unsatisfactory.

An ultimatum, telling what you will do in a certain case a day or a year in advance may be the height of foolishness. You do not know that you will be on earth to do anything, and you may be only suggesting to someone that he do something awful, that he had never thought of doing until you suggested it.

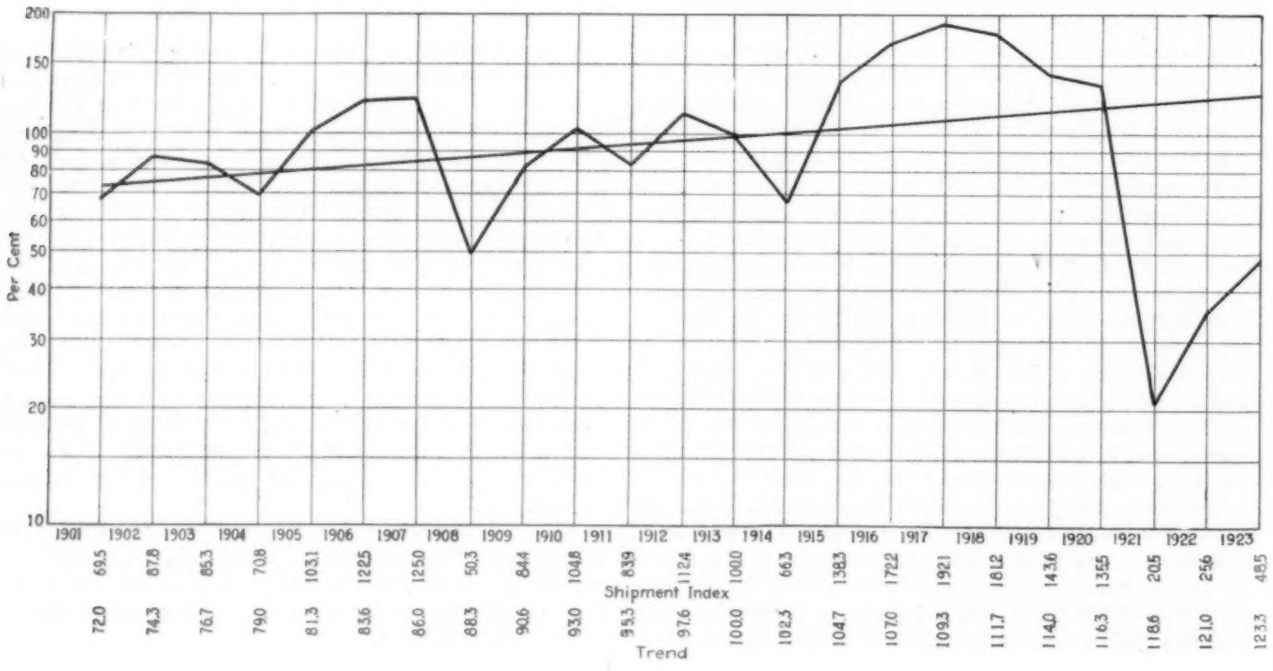
Permanent-Mold Casting of Aluminum Alloys

A study of the state of the art in the production of aluminum castings by the permanent-mold process has been made by the Department of the Interior at the Pittsburgh experiment station of the Bureau of Mines. Experimental work undertaken some time ago on the gating of aluminum alloy pistons on casting in permanent molds has been completed. It has been shown that the occurrence of blow-holes and related defects can be controlled by proper gating and pouring practice.

Shipment of Machine Tools

If anyone still has any lingering doubts as to what effect the war had on the machine-tool industry he has but to glance at the chart shown here to set them at rest. The chart was made up from the reports of twenty-nine representative firms by E. F. Du Brul, general manager of the National Machine Tool Builders' Association. Note that the figures are reduced to a basis of 100 as of 1913.

The first line of figures below the base line gives the yearly shipments in per cents of 1913. The line below that gives the trend figures assuming 1913 to be 100. It will be observed that although shipments for 1923 are nearly twice as large as those of 1922 they are less than half what they should be under normal conditions of industrial growth.



Development of Modern Stamping Practice

By W. W. GALBREATH and JOHN R. WINTER
President and General Superintendent, Youngstown Pressed Steel Co.

Early uses of pressed metal — Pressed steel in the automobile field—Replacement of cast-iron parts by pressed steel—Various applications of pressed steel

THE whole progress of man has been dependent upon the discoveries and inventions which he has made, and the greatest single step in this progress has been his discoveries in treating metals to accomplish certain desired ends.

The first metal used by man was copper—logically, too, because of its softness. This very softness, however, that was a point in favor of the early use of copper, was also the first to count against it. But when primitive man learned that the reddish earth we call iron ore could be smelted and made into tough, hard metal which would take and retain a point or edge, he stepped up from the primitive stage into the real mastery of the earth.

Every hour of the twenty-four that we live and

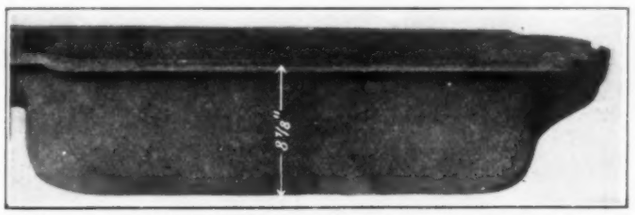


FIG. 1—PRESSED-STEEL CRANKCASE THAT REPLACED CAST ALUMINUM CRANKCASE

breathe—and even some of the hours that we slumber away into eternity—are affected by the use of metal—chiefly iron and steel. We sleep in a metal bed, made comfortable by metal springs covered with fabrics woven on metal machines. In the morning we jump into a metal tub, only practical because of metal pipes. Even our faces are kept youthful through the use of metal razors. To go into the details of the tremendous, but often unthought-of, part that metal plays in our lives would take more time than is now available. But because metal has become so common, so ordinary, so much a necessity of every movement in life, seldom does the real realization of the progress which the metal industry has made come to mind.

Primitive man had fire at his command at a very early period, and with its aid he was able to smelt ore and then hammer or cast the product thus obtained into various forms. For centuries, forging and casting were the only methods known for producing iron parts. Large quantities of parts were not required and for a long time slow, expensive methods of manufacture prevailed. Many can remember the cast-iron keys and the forged hardware that decorated the doors of homes only a few generations ago. Since quantities were small, there was little incentive to develop methods that would produce parts at high speed and relatively low cost.

Then came the development of the electrical industry which grew with amazing rapidity. The old-time gas-chandelier and oil-lamp manufacturers had been content with slow hand methods of spinning the light-weight metal parts that were required. The electrical industry, however, needed speed in the production of thousands of various parts that had to be uniform but usually with only thin walls and of no great size. Electrical manufacturers discovered that these parts could be pressed from steel and brass with amazing rapidity and accuracy.

The first electric door-bell bases, as well as the covers for the magnets, were cast affairs—expensive to make. Here was a simple stamping job, of thin material, easily handled and easily pressed. Split-hair accuracy was not required. Stamped metal boxes and bases have since become universal. Then the electrical industry found it could also press bells for gongs, railway signals, and such with equal facility.

In the telephone exchanges thousands of relays were required and each had to be fitted with a cover as protection against dust. The problem was relatively simple—just a tube about two inches in diameter and four inches deep. But quantity production was required and light presses could turn out the parts speedily and accu-

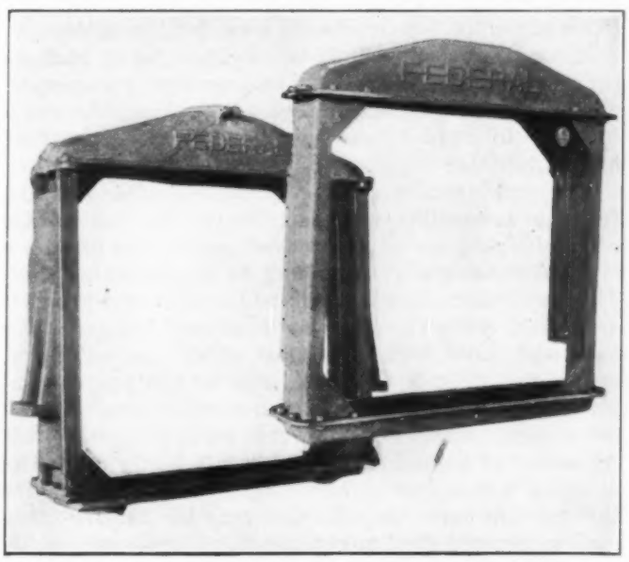


FIG. 2—LEFT: CAST RADIATOR SHELL WEIGHING 44 LB. RIGHT: PRESSED-STEEL RADIATOR SHELL WEIGHING 28½ LB.

Abstract of paper presented before the Machine-Shop Division of the American Society of Mechanical Engineers, at the annual meeting, Dec. 3 to 6, 1923.

rately. A glance at any desk telephone today will show that the instrument as well as the bell box is made almost entirely of pressed metal parts.

Shortly after began the phenomenal development of the automobile, and soon the primitive "horseless carriage" was raising the dust of the highways. But the automobile manufacturer followed a very ancient law, the "law of habit." Because he had grown up in the carriage and wagon business where castings, forgings, and wooden parts had been his daily contact, these were the parts he used. His vehicle was exactly as

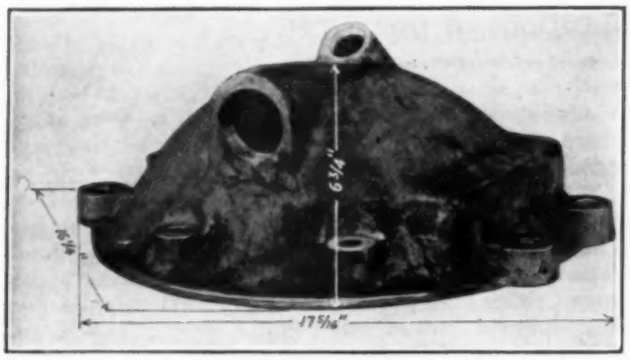


FIG. 3—CAST ALUMINUM HOUSING COVER WHICH WAS REPLACED BY ONE OF PRESSED STEEL

described, a "horseless carriage." Even the frames in the early machines were of wood. And no one today would want the enormous wheels that dignified the first gasoline chariots. The law of habit was strong, but the law of necessity was greater. Many castings were too heavy and too slowly produced. With greater production the automobile manufacturer could see the day coming when he would have to put in enormous quantities of additional equipment for performing the necessary machining and drilling operations required on cast parts. Most important, however, was the demand for lighter weight.

Pressed Steel in the Automobile Field

About this time the man with pressed-steel experience began to seek employment in the automobile field. His early activities in pressed steel for the automotive industry were confined to the lighter parts, such as clips, braces, and brackets. Here savings were accomplished that made it easier to get the automobile manufacturer to consider stamping the heavier parts of his car.

A typical instance of how pressed steel made a saving for one automobile manufacturer in the early days when chain drives were standard practice, is told by a man of many years' experience in the stamping field. This particular manufacturer had a combined sprocket and brake drum for the rear wheels of his car. The part was made from a casting which was expensive, heavy, and difficult to make. But by the proper combination of a pressed drum with a separate sprocket—not so easily worked out as words seem to convey—this pressed-steel engineer designed both a better drum and a better sprocket at lower cost. One can just imagine this manufacturer soon looking over his car for other savings pressed steel might bring.

In the automotive field the first major parts of a car that were pressed in large quantities were brake drums, and then frames and then hubs, and so on until today almost the entire car, body and all, is made of pressed steel.

What to the eye seems a rather simple job of stamping is very frequently a task which requires days and days of study and experimenting. The first brake drums produced were made by two drawing operations and had, as the pressed-steel man terms them, "picket fences." In other words, the edge of the flange was not true, but wavy, nor were the drums always perfectly round. Now pressed brake drums are manufactured by one operation.

Today a brake drum must be round within twenty thousandths of an inch, which in a 14-in. drum is surely a very slight variation from a perfect circle. This tolerance would not be difficult if every piece of sheet steel supplied had exactly the same thickness and exactly the same temper, but this is not commercially possible. This very difference, which cannot be overcome, causes stamping manufacturers the most of their difficulties.

Much thought and effort have been expended on the relatively simple process of pressing drums. One large manufacturer, whose plant turns out mountains of brake drums each year, tells of the obstacles that had to be overcome in producing a particular drum with an unusual profile of various sizes. A contract for making these drums (9 in. in diameter) out of ⅛-in. stock was secured. The dies were made and the job

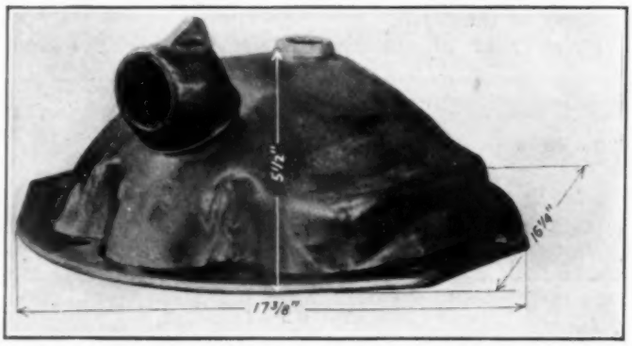


FIG. 4—DUAL REDUCTION HOUSING COVER OF PRESSED STEEL THAT REPLACED THE COVER SHOWN IN FIG. 3

went through the plant without a hitch. Then along came a contract for making the same drums 12 in. in diameter out of slightly heavier stock. Every one expected the work to go through with the same facility as before, but unexpected difficulties were encountered.

Cold sheet steel when subjected to several hundred tons' pressure in a heavy press really flows, or in other words, part of the sheet is stretched to make a thinner wall, and part forced into certain sections to make a thicker wall. In the 12-in. drum the steel did not act at all as it had in the smaller drums and too much metal concentrated at one point. However, after many hours of study and experimenting, perfect drums were finally produced.

But the story does not end here. Shortly after along came an order for 14-in. drums with the same profile and of proportionately heavier stock. With the previous experience on the 12-in. drums it would seem that no new problem could arise. But it did, for the 14-in. drums did not act at all as had either the 9-in. or the 12-in.; and the production of the larger drums had to be studied through just as thoroughly as that of the two smaller ones.

This particular experience is cited at length to point out that even though two pressed-metal pieces appear the same and are used for the same purpose, there is no known rule that can be applied to the action of the metal, when under pressure, that works satisfactorily in all cases.

The production of pressed parts of large size requires infinite patience, coupled with a wide knowledge and experience of the action of steel under various conditions and an understanding of why and how each job differs from another. Success in the use of pressed parts can be assured only when this experience is employed. Fortunately, there are today a number of stamping organizations in the country that have this ability.

Considerable emphasis has been placed on brake drums in the preceding paragraphs, but the conclusion should by no means be drawn that brake drums are the only pressed parts of an automobile. There are hundreds of pressed parts on every automobile today.

Another one of the interesting phases of the development of pressed-steel parts for this industry is the replacement of cast-aluminum parts. As previously mentioned, lightness was one of the influencing factors in the automobile industry that pressed steel helped to solve.

Before pressed steel occupied the important place it does today in the automotive field, manufacturers turned their attention to lighter metals, chiefly aluminum, in attempting to reduce the weight of their cars. In many instances, however, pressed-steel parts have even excelled aluminum in lightness, not to mention the additional advantage—saving in costs.

Pressed Steel for Weight Reduction

In one case a cast aluminum crankcase weighed 13.5 lb. while the pressed-steel crankcase which replaced it, shown in Fig. 1, weighs only 12 lb., or 1½ lb. less than the aluminum part it replaced. Both crankcases are identical in size and accomplish the same purpose, but the pressed-steel part made a substantial saving in both cost and weight for the manufacturer.

In the replacement of cast-iron parts, pressed steel has effected very many savings, both tangible and intangible, for the automotive industries. Fig. 2 shows two radiator shells used on a well-known truck in which the use of pressed steel saved the manufacturer 35 per cent in material tonnage alone. In addition, many machining operations were eliminated and the parts were delivered to the plant ready for assembling. Moreover much less weight had to be hauled both in and out of the plant, as well as by the truck during its whole period of usefulness.

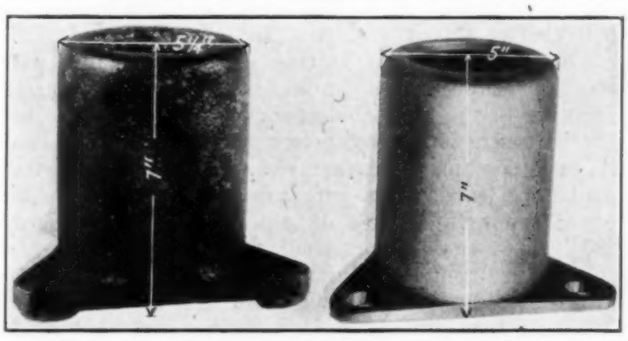


FIG. 5—CAST-STEEL (LEFT) AND PRESSED-STEEL PINTLE HOUSINGS

A particularly interesting example of the application of pressed steel to the automotive field is illustrated by the redevelopment of a dual-reduction housing cover from cast aluminum to pressed steel (Figs. 3 and 4). By the very nature of the method of manufacture, a cast part is usually one solid unit. All projections, bosses, etc., can be cast as integral parts of the main member. In considering such a part from a pressed-steel production standpoint, it frequently happens that the cast part has to be viewed from its component parts. Here is where the ingenuity of the pressed-steel engineer comes to play. In this dual-reduction housing cover the problem was to provide material for the necessary tapping of the two small openings. This demand was successfully and cleverly met by the insertion of a steel flange and cast-iron elbow, which provided the necessary tapping facilities. While the weight of the whole part was increased very slightly, this was not a vital factor, and the cost of the pressed part represented a very substantial saving over the cast part. Particular attention is directed to this redevelopment, because many parts that at first are apparent impossibilities for pressed-steel redevelopment can be produced by those who are experienced in this work and who recognize that a completed pressed part is often secured by the combination of several different pressed units. The only way of making sure that any part cannot be successfully produced by stamping methods is to submit the part in question to a competent pressed-steel engineer.

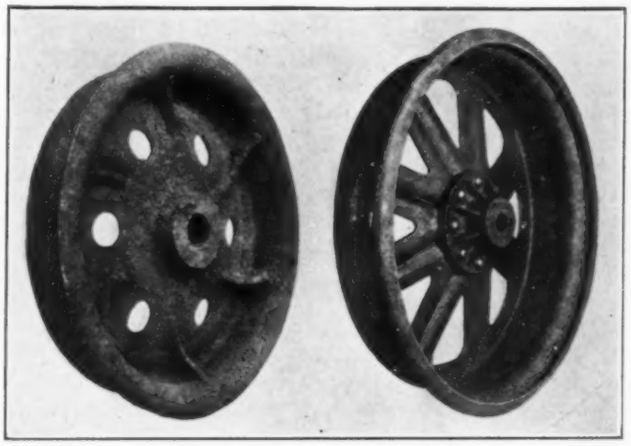


FIG. 6—CAST-IRON AND PRESSED-STEEL INDUSTRIAL CAR WHEELS

But while the automotive manufacturer had been building his business through the use of pressed-metal parts and thus obtained not only the required quantity production but was also able to turn out better cars at lower prices because of the savings accomplished, a few other manufacturers made desultory attempts to apply the pressed-steel idea. During the war, both small and heavy pressed parts were used in enormous quantities. The casting capacity of the country was limited and could not begin to fill the requirements, so that pressed steel met an urgent need.

Pressed-steel shells are familiar to all, but a typical war development of pressed steel is illustrated by a cast-steel pintle housing (Fig. 5) developed into pressed steel. In this instance not only was the saving in weight a strong incentive, when the demand was for

conservation, but the difference in method was of first importance, since all casting capacity thus released could be more effectively used on other parts where casting was an absolute requirement.

During the peace-time prosperity which followed the war, many of these manufacturers who had watched the development of pressed steel in the automotive industry and who had seen the war-time use of pressed metal, cast about for less costly methods of securing parts. But the real possibilities had to be brought home by those interested in the manufacture of pressed parts, and unfortunately many manufacturers have been too lethargic in appreciating the value of pressed steel. As a case in point may be cited the experience of one pressed-steel salesman with a gas-meter manufacturer.

Noticing one day that the covers of the meters made

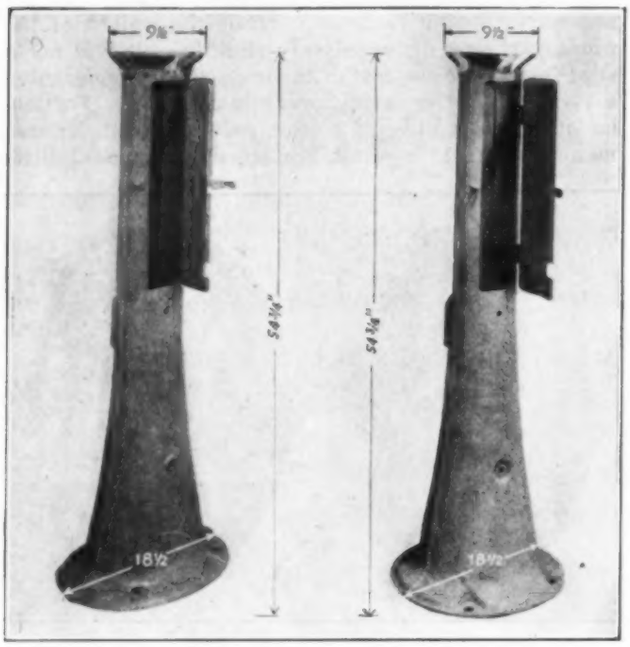


FIG. 7—CAST- (LEFT) AND PRESSED STEEL GASOLINE-PUMP BASES

by this manufacturer were castings and required a number of drilling and machining operations to secure a proper fit, the salesman paid him a visit and discussed the advisability of making them out of pressed steel. This material did not at first seem to meet the requirements, but the problem was studied and a pressed-steel meter cover designed that not only saved the meter manufacturer many dollars in first cost, but also eliminated a number of expensive machining and drilling operations. In addition, a troublesome problem in breakage of the cast covers was solved by the employment of pressed steel.

One pressed-steel redevelopment, made for a manufacturer of gasoline section cars—the type so often used by railroad track gangs—is a striking example of the weight saving that pressed steel often accomplishes. This manufacturer had been using a cast-iron wheel 20 in. in diameter on the tread and weighing 125 lb. The redevelopment of the cast wheel into a pressed wheel, to which a cast-iron hub was fastened, reduced the weight 78 lb. Of even greater importance was a cost saving of over 50 per cent. In Fig. 6 photographs of both wheels are reproduced.

Many of the gasoline pumps seen at filling stations are definite object lessons in pressed steel that can be applied to the business of a customer provided he uses any cast parts. Take for example the pump base shown on the left in Fig. 7. This base consisted of two cast parts 54¾ in. high, with a cast door giving access to the mechanism installed in the interior. From the layman's standpoint the base looked like an impossibility for pressed metal because of its great length and the number of minor attachments, such as hinges and door latch, that were an integral part of the large casting. But a pressed-steel engineer who knew how to attack such problems studied the casting not as a whole but in all its various parts, and worked out ways by which these smaller parts could be reduced to pressed-steel possibilities. The results of this study are to be seen in the pressed-steel pump base shown at the right.

Correct design, big, heavy-duty presses, the acetylene torch, and electric welder produced a pressed base made up of twenty-five separate pressed pieces which, when assembled, weigh less than half as much as the cast base—60 lb. of pressed metal against 155 lb. of castings. In addition to the material savings must be considered the collateral savings in freight and ease of handling, as well as the elimination of machining costs and breakage.

Savings Through Use of Pressed Steel

Many manufacturers who have learned by actual experience the exceptional advantages pressed steel has accomplished in one part, have carried the saving thus secured to other parts of the same equipment. A stove manufacturer who was induced to adopt pressed-steel legs for his stoves found the savings so substantial that he developed several other cast parts such as door frames and doors into pressed parts. Another feature —of selling importance—was found in the fact that pressed parts take enamel finish better than cast parts.

One wringer manufacturer is now using pressed parts in place of cast parts for all of the metal work on his product with the exception of the clamping screws. A washing-machine manufacturer redesigned his entire machine and kept in close touch with the engineering department of the stamping organization that made his stampings—with the result that he now has a machine that uses pressed steel most effectively and presents a much better appearance.

The opportunity of getting a better product with stronger selling points can be secured by many a manufacturer in the household-appliance field if he will but get in touch with a competent stamping organization. A gasoline-pump manufacturer who had had previous gratifying experiences with pressed steel, was considering the manufacture of an oil-tank truck. Ordinarily his own designers would have planned the entire job, but his confidence in the pressed-steel organization and the results it had secured for him led him to find out first how pressed steel could be used in its construction. The truck was designed entirely in the stamping manufacturer's plant and every part, except the castors, is pressed metal.

There is scarcely a plant in this country using metal parts that cannot apply pressed metal to advantage, no matter if the product is one of long standing or whether a new product is under consideration.

It is not the aim of the pressed-metal manufacturer to eliminate castings, for there are thousands of parts which are cast that cannot be produced in any other

way. But pressed metal is making a wonderful contribution to industry in speeding up the production of parts, reducing excessive unnecessary weight, eliminating many expensive machining operations, and saving material and handling costs, in addition to savings in plant investment that would have to be made to take care of many finishing operations required when cast parts are used. The same advantages which many industries today are getting from the use of pressed parts can be obtained by almost any manufacturer who will get the facts on his own products. The pressed-metal industry is ready and waiting to serve him.

Heat Treatment of Carbon Steel Castings

THE recommended practice given herewith is intended solely for guidance and is not to be construed as entering in any manner into specifications of the American Society for Testing Materials. When adopted as standard, it will supersede the present recommended practice for annealing of carbon-steel castings as given in the 1921 Book of A.S.T.M. Standards.

The castings should be sufficiently cleaned of adhering sand before annealing to insure thorough and uniform heating. It is, of course, inadvisable to sand blast the castings before annealing.

The castings should be heated slowly and uniformly to temperatures varying with the carbon content of the steel, approximately as follows:

Carbon, per Cent	Temperature
Up to 0.40	900° C. (1652° F.)
0.40 to 0.60	850° C. (1560° F.)
Above 0.60	830° C. (1525° F.)

The castings should be kept at the maximum temperature a sufficient length of time to insure the refining of the grain. Generally, from one to two hours is required to accomplish this refining after the steel has reached the maximum temperature. As it requires a considerable length of time for the interior of a heavy piece to reach the indicated temperature of the furnace, it is recommended that the castings be held at the maximum temperature at least forty-five minutes for each inch of thickness of the castings and that to the time estimated from one to two hours be added to insure thorough grain refining throughout the piece.

The castings should be cooled slowly and uniformly in the furnace, when it is desired that the steel shall possess the maximum softness. In the case of very heavy castings of comparatively uniform section they may be cooled in the air. It is, of course, quite unnecessary and superfluous to use this method as preliminary to any of the methods outlined below.

The castings may be cooled at an accelerated rate when it is desired that the steel possess rather higher tensile strength. Elastic limit can be procured by slow cooling. The cooling must be so conducted as to leave the steel reasonably free from cooling stresses. The castings may be withdrawn from the furnace and buried in a bed of material that is a poor conductor of heat; or the annealing furnace may be so thrown open so that the castings will cool more rapidly than they would if the furnace were left closed. Should, however, the castings be of such uneven section that they cool at unequal rates at various points when the furnace is opened, especially if the carbon of the steel is high, the furnace should be closed immediately after the castings have become black.

If the sections of the castings are such that the castings will cool in air, from the annealing temperature, to a black heat in less than 30 min., the castings may be withdrawn from the furnace and cooled in the air. When a car-type furnace is used, this may be accomplished by withdrawing the car from the furnace and allowing the casting to remain on the car. In this case, however, care should be taken in loading the car so that the castings will cool as uniformly as possible.

When the greatest possible strength and elastic limit for any given extension and contraction are desired, the castings may be quenched in oil or water followed by reheating, provided they are of suitable design and section.

Certain castings which would crack if held in the water or oil until completely cold, may be safely treated by removing them from the bath when they have reached a black heat, placing them in a furnace at approximately the same temperature as the castings and immediately reheating them as described.

Castings which have been cooled in air, or quenched in water or oil as described, should be reheated to a temperature not exceeding 675 deg. C. (1,247 deg. F.). If there is danger of cracking the castings in this reheating, on account of the stresses set up by previous rapid cooling, this second heating should be at a slower rate than the first heating. In no case should the rate for the second heating exceed that for the first heating. The castings should be held at the given temperature at least one hour for each inch of section to insure thorough and uniform heating throughout the piece. To this time of exposure to the maximum temperature should be added at least two hours to complete the drawing of the interior of the castings. After the drawing is completed, the castings may be cooled as desired either in the furnace or in the air.

In general, the shock toughness of the steel is considerably improved, and the elastic limit considerably raised, by air cooling and drawing as compared with these properties in a similar steel when annealed. Both these properties are still further improved by quenching and drawing.

Pressed Metal Engineering

Under the title "Pressed Metal Engineering—Some Principles and Examples," Douglas P. Cook, President of the Boston Pressed Metal Co., Worcester, Mass., presented a paper before the Machine Shop Practice Division of the American Society of Mechanical Engineers at the annual meeting held during December.

The subjects taken up in Mr. Cook's paper are the scope of the industry; the "jobbing" pressed metal industry; importance of engineering functions; the process, its diversity and complexity; rapid growth of the industry; the automotive demand and its relation to the pressed metal industry; general lack of understanding about the industry; lack of engineering standards and information; erroneous designs; unwise specifications; possibilities and imitations of press production; first cost versus ultimate economy; the question of tools; search for broader markets for pressed metal; the pressed metal sales engineer; discussion of sales models and drawings; examples of pressed metal design.

An exhibition of lantern slides accompanied the paper. The slides showed numerous examples of redesign in pressed metal of parts originally designed as iron, brass, aluminum and malleable castings, screw machine products, die castings and forgings.

Ideas from Practical Men

Devoted to the exchange of information on useful methods. Its scope includes all divisions of the machine building industry, from drafting room to shipping platform. The articles are made up from letters submitted from all over the world. Descriptions of methods or devices that have proved their value are carefully considered, and those published are paid for

Large Work on a Small Machine

By C. H. Hays

Through a change in design of one of our products it became necessary to find a method to machine some castings to a 23-in. radius. Being equipped to handle small work only, we designed and had built the fixture shown in the illustrations herewith.

In Fig. 1, the fixture *A* is shown mounted on the

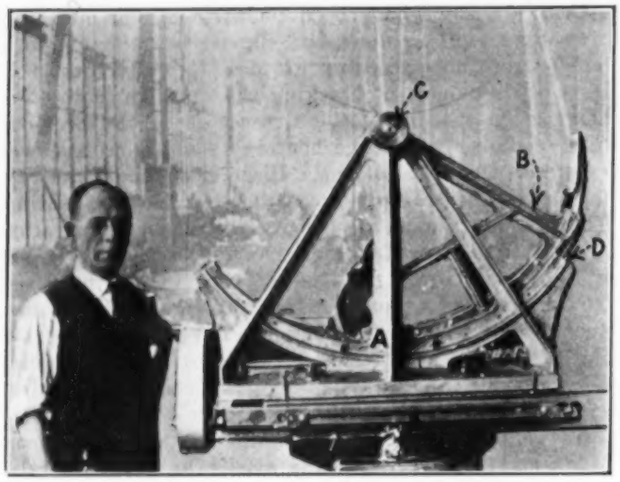


FIG. 1—FIXTURE FOR RADIUS MILLING

table of a No. 2 Brown & Sharpe milling machine. The swinging segment *B*, to which the work is attached, is pivoted at *C* and guided by the gibbed slide *D*. The segment has teeth cut in the circular part and is driven by a worm on the shaft *E*, Fig. 2, the shaft being driven from the regular feed mechanism of the machine. This view is from the working side of the machine and shows the gibbed slide *D* more in detail.

The work *G*, is shown in Fig. 3, the cut having been completed. This view also shows the clamping arrange-

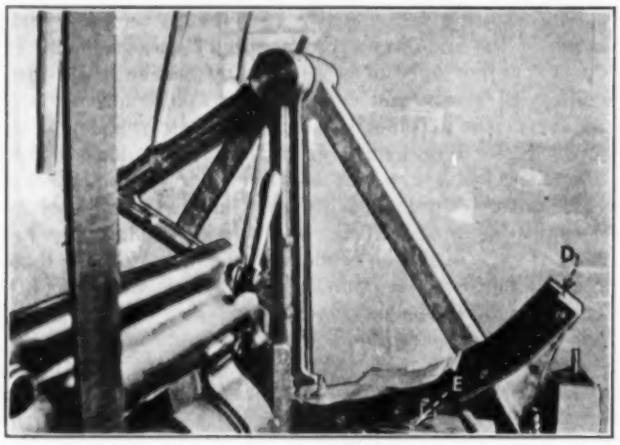


FIG. 2—DETAILS OF THE FIXTURE

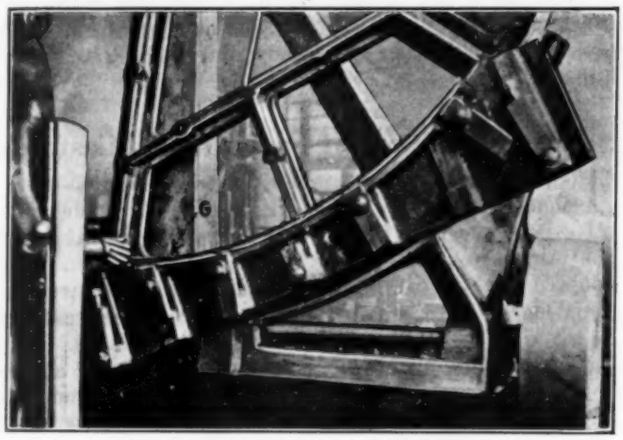


FIG. 3—HOW THE WORK IS HELD

ment by which the work firmly is held to the segment.

The fixture will handle work requiring the milling of radii from 6 to 30 in. and having an included angle of 80 deg. The radius to be milled is governed by the vertical position of the knee on the column of the machine.

An Ingenious Arrangement for Multiple Drilling

By J. A. Long

For the purpose of lightening the connecting-rod, it is customary in one automobile shop to drill 11 holes through the web of the rod. This operation is performed by means of the multiple drilling mechanism shown in Fig. 1, which was built on the bed of a discarded bench lathe.

A top view of the device is shown in Fig. 2, and it

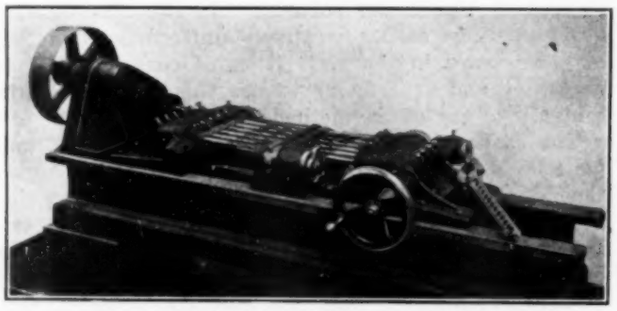


FIG. 1—MULTIPLE DRILLING MECHANISM

will be noted that the drills are disposed on either side of the jig at the center, six drills operating from the left-hand side and five from the right. The driving pulley is located at the left-hand end of the bed and drives the longitudinal shaft *D* through a train of gears.

The drilling heads *E* and *F* are split along the center

lines of the transverse shafts *O*, Fig. 3, as shown at *K*. These transverse shafts are driven through the bevel gears *J* from the longitudinal drive shaft, and carry long helicoidal gears which mesh with helical gears *N* on the drill spindles *G*. The drill spindles are mounted in bronze bushings *H*, the thrust being taken by the ball-bearings *I*. The drilling heads are arranged to slide on the ways of the lathe.

The jig for holding the work is composed of the base

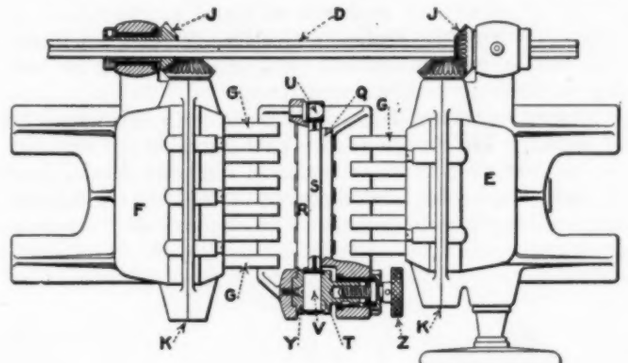


Fig. 2

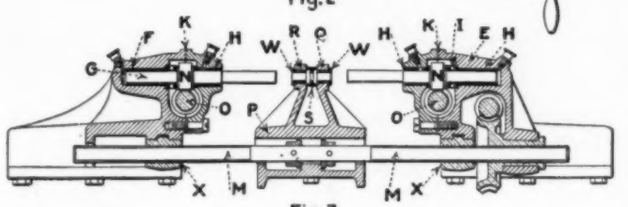


Fig. 3

FIG. 2—TOP VIEW OF HEADS AND JIG. FIG. 3—SECTION SHOWING SPINDLE MOUNTING AND FEED

P, fixed to the lathe bed, and carrying two parallel bosses, *Q* and *R*, in which are located the drill bushings *W*. The bosses are properly spaced to permit the positioning of the connecting rod *S* between them, the wrist-pin end of the rod being located on the pin *U*. The other end is positioned by a sliding button *V* controlled by the screw *Z*. When in position on the button, the action of the screw clamps this end of the rod tightly between the shoulder-block *T* and the locating-block *Y*.

The heads are fed in and out from the jig by means of the right- and left-hand screw *M* which is prevented from moving longitudinally by two collars, one on either side of a boss in the jig. The screw rotates in the nuts *X* carried in the drilling heads, thus producing the feeding motion, the rotation being accomplished by means of the worm gearing located in the right-hand head. The worm shaft is rotated by means of the handwheel shown in Figs. 1 and 2. The wormwheel is, of course, feather-keyed to the screw.

A drilled connecting rod is shown at the right of the device in Fig. 1, and the maximum production of drilled rods on this operation is 100 pieces per hour.

Roll Grinding in California

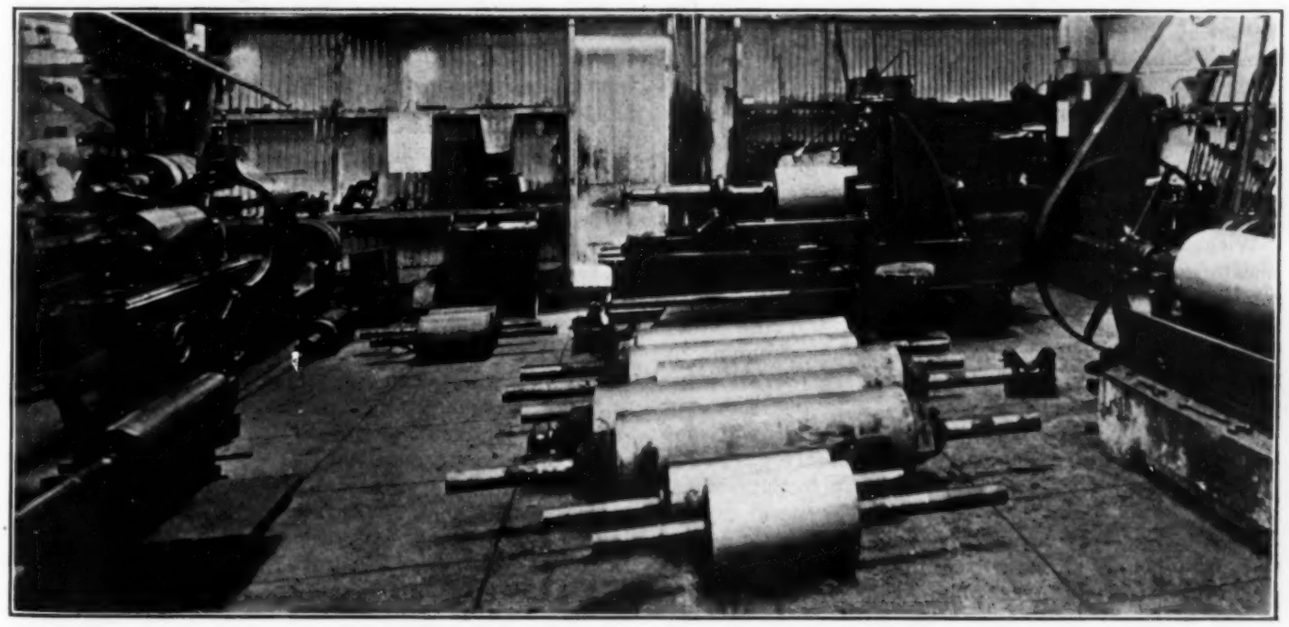
BY HERBERT CRAWFORD

Roll grinding is not an everyday operation in any part of the country, although there are a few centers where it is more common than in others. The illustration is from the roll grinding department of the Llewellyn Iron Works, Los Angeles, Calif.

The small rolls in front are for crushing or grinding barley and have spiral corrugations. They are made of chilled cast iron. The larger rolls on the floor and in the grinding machine are used in making cotton-seed oil. These rolls have no fluting but are ground smooth. Similar rolls are used by the rubber industry, there being a very large tire plant just outside of Los Angeles.

The machine at the rear is an automatic planer for cutting the spiral corrugations. The work in place is an 18-in. roll for barley.

The grinding machine at the right is a Morton-Poole grinding machine, one of the notable machines for grinding rolls, and developed many years ago. This particular machine has been modified to handle the large variety of grinding which comes to this department and will accommodate rolls up to and including those of 18 in. in diameter and 48 in. in length.



GRINDING ROLLS FOR BARLEY AND COTTON SEED OIL

Two Ways of Making a Core—Discussion

BY F. C. EDWARDS
Birmingham, England

In his article under the above heading, published on page 152, Vol. 59, of the *American Machinist*, M. E. Duggan makes some remarks that somewhat alter the status of our bone of contention and brings us, on most points, to a condition of substantial agreement.

That there is a proper method attainable for every pattern made—that is, a method of pattern construction and molding best calculated to serve its specific purpose and to produce the highest efficiency in the foundry in which it is to be used—I still maintain. The actual achievement of the proper method is another question. The ideal is sometimes far removed from the real.

I find myself partly in agreement with Mr. Duggan on one point in his article and completely so in another. I certainly cannot give unqualified indorsement to the statement that the average patternmaker is unable to predetermine the operations of the molder. Speaking from personal experience (and it may not be out of place to mention that I have had charge of seven different pattern shops in various parts of England since first I trod the thorny path of foremanship in the year 1895) I have found the average patternmaker generally reliable on the ordinary run of work.

With anything uncommonly intricate, of course, assistance from the foreman should always be forthcoming. The foreman is more immediately in touch with the drawing office, the foundry and the other departments concerned, and therefore his command of relevant data is the more comprehensive, irrespective of his personal experience.

It is my invariable custom in such cases to discuss the job freely with the patternmaker before a start is made. Indeed, when I find it necessary to put several men on one job I usually hold a sort of general conference, inviting the utmost freedom of speech and criticism from every one present, and build up a general line of action to be followed in the construction of the pattern. Each successive step is viewed from many angles and is decided upon according to the weight of argument for and against. Everyone on the job is, therefore, thoroughly conversant with the route to be taken in subsequent steps.

This preliminary analysis eliminates wasted effort, achieves the best final result, and is found to speed up production considerably. The most unwieldy job can thus be sectioned up and each man given a particular section, with clear ideas on its relationship to the job as a whole. In handing out these sections it is understood—since not all men are of equal ability—that in order to secure the highest collective efficiency one must differentiate to some extent between individuals according to their respective capacities.

I agree with Mr. Duggan *in toto* as to the necessity of foundry knowledge to the patternmaker. Certainly one cannot predetermine molding methods as the poet is held by some to discover truth—by intuition. Experience (which connotes experiment) and observation in the foundry itself, with an ever-ready willingness to listen to the views of the foundryman is, beyond question, the key to the situation. Armed with the key, the patternmaker is not only able to solve most of his immediate problems but he may at times simplify the molding by suggesting appropriate alterations in design.

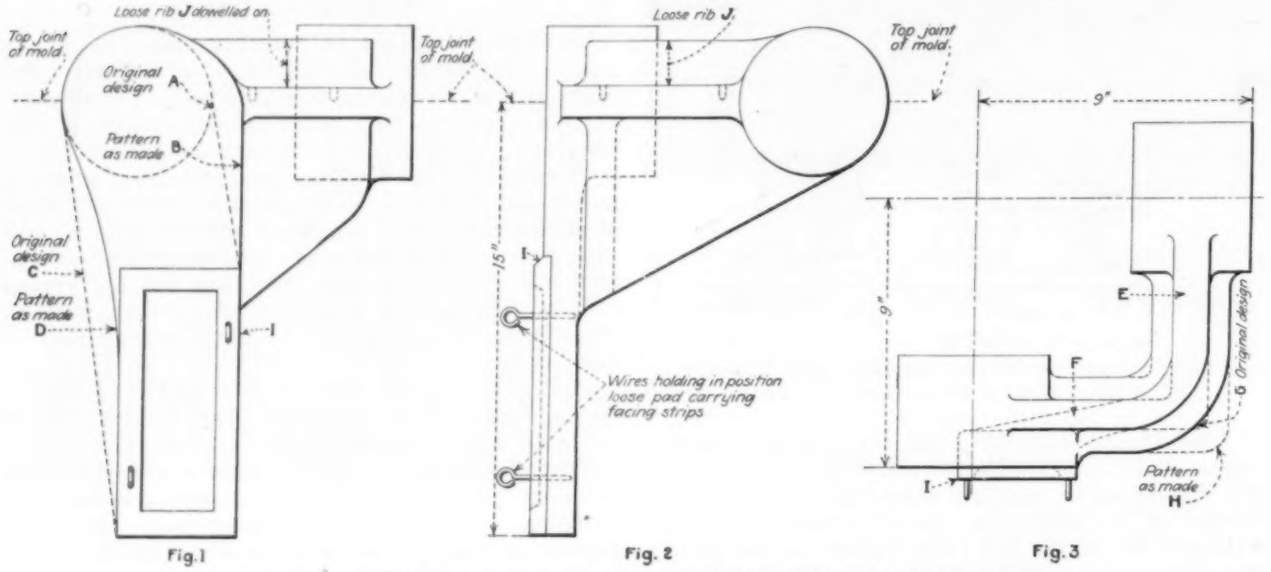


FIG. 1—FRONT ELEVATION. FIG. 2—SIDE ELEVATION. FIG. 3—PLAN OF PATTERN

An example of this latter class is illustrated by Figs. 1, 2 and 3, which are front and side elevations and plan, respectively, of a double bracket. On looking over the blueprint it was at once realized that this job, as designed, presented special molding difficulties. To produce a casting with the upper portion bevelled back, as shown at *A*, Fig. 1, would entail coring or—the molder's pet aversion—deep jointing. It was therefore suggested to the drafting room that the design be altered to bring the side up square, as at *B*. It was further suggested (though this did not affect the molding) that the straight side *C* be altered, as at *D*, in order to improve its appearance.

On the plan, Fig. 3, a large radius was shown at the junction of the sides *E* and *F*, as indicated at *G*. By reducing this radius, as at *H*, the pattern itself would be easier to make and would, moreover, be much more durable. Here, again, the drafting room was quite agreeable to the suggested alteration.

The groundwork of the pattern thus resolved itself into two side pieces *E* and *F*, screwed together at right angles, with bosses and ribs afterwards added. The pad *I*, containing the lower facing strips, was wired on loosely, to be withdrawn after the removal of the pattern. To facilitate molding operations further, the top piece *J*, Fig. 2, was dowelled on so as to lift up with the cope. It will be seen that a very simple job —both in pattern shop and foundry—was thus evolved from what originally promised to be a very difficult one.

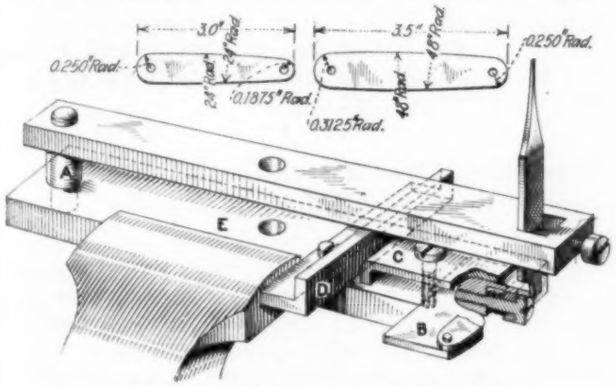
The above case exemplifies the indispensability of a sound knowledge of foundry practice to the pattern-maker. Lacking this essential (since slight variations either in size or shape may entail kaleidoscopic changes in their respective methods of molding) he is little more than a blind tool. Possessing this knowledge he is not only in position to predetermine foundry operations on a given job but, with the aid of a sympathetic drafting room, he may so influence design as actually to anticipate foundry difficulties.

Device for Finishing Accurate Radii

BY JAMES M. CALL

Some time ago a small and not too well equipped tool and gage shop of which the writer was part owner, was favored with an order for a large number of the pieces shown in the sketch. The pieces were to be used as gages and were therefore to be hardened and must be accurate as to contour and dimensions as well as smooth and neatly finished as to surface.

The long sides of the pieces were to be finished to



DEVICE FOR MAKING ACCURATE RADII

true radii, 24 and 48 in. respectively, and to make these radii to the necessary degree of accuracy and finish, the tool here described was devised. In operation it was held in the jaws of a bench vise, which seemed to be the most convenient way of holding and operating it.

For the base bar of the device, a piece of flat cold-rolled steel of suitable strength and thickness was procured and holes drilled in it to take the shouldered stud *A*, which was to be the center of the respective radii. A rectangular shaped hole was made through the bar at the end opposite to one of the stud holes and to this hole was fitted the projecting lug of what may be called the feeding slide, *B*, to which the work was attached.

The upper surface of the feeding plate was provided with small locating pins over which the work was placed. A tapped hole through the downwardly projecting lug took the threaded end of a fillister head screw which passed through a body sized hole in the end of the bar, and a coil spring between the lug and the outer end of the rectangular hole in the bar kept the feeding screw always under tension and eliminated backlash.

A light clamp *C* was provided to hold the work in position on the pins, yet not to bind it so firmly that it could not be moved outward by turning the feeding screw. A piece of angle iron *D* was attached by screws to the upper surface of the base bar to act as a rest for the swinging arm. No special accuracy was needed in making this base bar except, as a matter of course, that the lug of the feeding plate should be a smooth sliding fit in the rectangular hole, and without appreciable shake.

The remaining part of the device was the swinging arm *E*, having two holes spaced 24 in. apart to fit over the fulcrum stud (this being the difference between the respective radii) and a square hole to take the tool; the inner, or clamping, side of which hole must be 24 and 48 in. from the centers of the respective stud holes.

To lay out the contour of the pieces preparatory to roughing them out, a special scriber was clamped in the swinging arm and lines scribed on the pieces. The pieces were then planed or milled as closely to line as possible and returned to the device for finishing. A pillar file held in the swinging arm was the finishing tool while the pieces were in the soft state, and after heardening them a lapping stone was substituted for the file.

Mandrel for Pressing Bushings on Ford Driveshafts

BY R. W. THOMAS

It is sometimes difficult to get the bushing on a Ford driveshaft, especially in a shop where there is no press or where the press is too small for the job. Driving the bushing on almost always causes trouble. Not having the proper press, I made the device illustrated herewith, and utilized the lathe as a power press. The operation is as follows:

Place the drive shaft, Fig. 1, in the lathe leaving

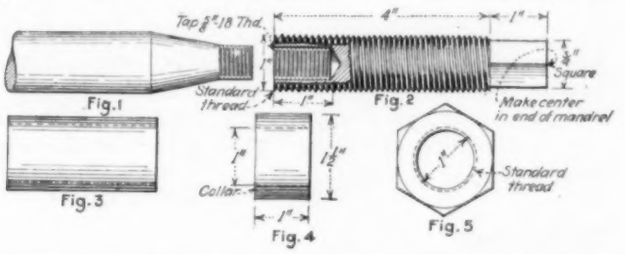


FIG. 1—END OF FORD AXLE. FIG. 2—THREADED PIECE FOR END OF AXLE. FIG. 3—THE BUSHING. FIG. 4—COLLAR TO GO BEHIND BUSHING. FIG. 5—NUT FOR FORCING COLLAR

about 6 in. of the threaded end projecting from the chuck. Then screw the piece, Fig. 2, on the threaded end of the shaft until it comes up to the shoulder. Next slip the new driveshaft bushing, Fig. 3, over the threaded piece and as far on the shaft as it will go. Place the collar, Fig. 4, over the threaded piece and run the nut, Fig. 5, up on the threads until it goes up against the collar. Bring the tailstock of the lathe up, put the center against the end. With a wrench on the nut put the lathe in low gear and start it. This will press the bushing in place easily and quickly.

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KENNETH H. CONDIT AND FRED H. COLVIN

Editors

December 13, 1923

What Will You Give Toward Research Work on Gears?

GEARING problems have furnished fascinating work for researchers ever since the ancient days when the ordinary wheel with wooden plugs in its periphery was used to transmit power.

At no time have the makers and users of gears been entirely satisfied with their knowledge of gears. Their inability to confidently predict the strength of teeth is still baffling, and absolute quietness cannot be guaranteed.

Progress has been made nevertheless. Several investigators have contributed to our present store of knowledge. Among them Wilfred Lewis, some thirty years ago, made an investigation of the strength of gear teeth based upon tooth forms in common use. About two years ago he proposed to the General Research Committee of the American Society of Mechanical Engineers the development and construction of a machine for testing the strength of teeth, with the result that a special committee on research of gears was appointed. An appropriation by the A.S.M.E. has enabled the making of general and detailed drawings. An article by Mr. Lewis outlining the steps taken in the work and explaining the design of the proposed machine is given in this issue.

Only lack of funds can now hold back the building of the machine and the carrying out of its tests. As a nest egg donations have been secured from some of the gear manufacturers, some of the machine-tool builders and from technical magazines. More money is needed and donations will be accepted by Mr. Lewis, whose address is the Tabor Manufacturing Co., 6225 Tacony St., Philadelphia, E. W. Miller of the Fellows Gear Shaper Co., Springfield, Vt., or Ralph E. Flanders of the Jones & Lamson Machine Co., Springfield, Vt., all members of the committee. The support of this very worthy project is urged.

Mobilizing Industry

THE RECENT article in *American Machinist*, by Assistant Secretary of War Dwight F. Davis, is well worth careful consideration. We should particularly note his statement that man power can be mobilized, trained and placed in action a year before munitions can be made and transported to the firing line. Mr. Davis is of course basing his data on the late war, and on that basis he is right.

It must be remembered, however, that the real delay was not so much in the actual making of the munitions as in the time taken to decide what was wanted and in the unnecessarily difficult designs and specifications which were given out for manufacture. The first requirement of any munition is that it shall function properly, regardless of the difficulties involved in manufacture. But much of the troubles and delays were due to designs which could have been simplified and specifications which were needlessly severe in many cases.

If the machine industry is given designs and specifications which are the result of joint conferences between ordnance officers and engineers who are skilled in modern production methods, munitions can be turned out much more rapidly than was the case in 1917 and 1918.

It is obvious then that this is the point where the greatest good can be accomplished in any plans to secure the co-operation of industry. Now is the time to begin to get the designs for everything needed by the army and navy in such shape that the desired munitions, or whatever it may be, can be put into production with the least delay and manufactured in the most efficient manner. For efficiency means increased production and lower costs.

It cannot be urged too strongly that the question of designs and specifications receive careful attention in every department. There is no wish to prevent ordnance officers getting what they want but rather the desire to help them get it more quickly. The production engineer can do far more to win a war by helping to simplify designs and specifications in advance than by all his efforts to produce work which is unnecessarily difficult after a war begins.

Why not call in the men who understand modern production methods now and utilize their knowledge on all kinds of munitions?

Three Requisite Characteristics of the Successful Shop Manager

ONE of the best known and liked, and most respected men of the machine tool industry gives three characteristics which the successful shop manager must possess. They are: an open mind, a well developed spirit of charity and a good sense of humor.

He did not lay particular stress on any one of the three as being most important but we are inclined to believe that he rather leans to the last mentioned virtue. Certainly its possessor has a far better chance to escape an early death from worry and nervous exhaustion in these difficult days. And he has a better time while he is exercising it.

Charitable treatment of the mistakes of others may well serve to soften the blow when one's own mistakes place him in a precarious position.

As to the open mind, lack of it is about as sure a bar to success as can be imagined. What is the use of arguing with a man whose mind has already been made up, often from insufficient knowledge of the facts? Progress is the spirit of our time and the man who shuts his mind to new ideas cannot but fall hopelessly behind the procession.

Seldom has a more succinct bit of philosophy come to our notice. We commend it to your thoughts.

Shop Equipment News

Cincinnati Climax Shapers

In the line of shapers, known as the Cincinnati Climax shapers, now being put on the market by the Cincinnati Shaper Co., Cincinnati, Ohio, all speed and driving gears are placed entirely within the column, there being no overhanging change-gear box on the outside of the machine. It will be seen from the general view of the machine, shown in Fig. 1, that the levers for starting, for speed control, for feed engagement and variation, for ram adjustment, and for stroke adjustment, are all easily reached by the operator without leaving his working position. Direct reading indicators for speed, feed and length of stroke are provided. The main helical-type crank-gear is of semi-steel, made in one piece, and all other gears are made from heat-treated chrome-nickel steel. The machine is completely guarded, both for the operator's protection against danger from moving parts and belts, and for the protection of sliding surfaces against chips.

The drive is of the single pulley type, with friction clutch and brake, the pulley shaft being mounted on Timken roller bearings. The machine may be driven by a motor mounted directly on pads on the back of the column and base, the arrangement making it possible to attach the motor at any time without difficulty. The speed of the drive pulley is such that the proper range of cutting speeds can be obtained by using a motor running at 1,800 r.p.m. The speed gears, placed within the column, run in oil and slide on integral multiple splined shafts which are supported at both ends, making a compact and rigid mechanism. The gear chamber, Fig. 2, forms a reservoir for the oil used for lubricating the drive gears as well as the rest of the machine. Eight selective changes of speed are provided, ranging from 11 to 138 cutting strokes per minute on the 16-in. size, and from 9 to 102 cutting strokes per minute on the 32-in. size.

The length of stroke is maintained without the usual clamping nut on the stroke adjusting shaft, as this is taken care of automatically. The indicator shows the setting for the length of stroke whether the machine is running or not.

The unique feature of the feeding movement is that it is actuated by cams and not by an eccentric and ratchet. This provides for a gradual rather than an abrupt feed and confines the entire feeding movement, under all conditions, wholly within the limits of the return stroke. Another feature is that the general feed arrangement is placed on the side of the column instead of at the end of the crossrail. This takes the bulk of the feeding mechanism out of the operator's way.

Eleven feeds, ranging from 0.010 to 0.170 in. per stroke, are provided. The feed variation is conveniently accomplished by means of a lever mounted on a direct reading dial, which indicates the feed in thousandths. The feed engagement lever has the three positions, "Stop", "Right-hand" and "Left-hand", indicating the direction of the table movement. A safety friction clutch device protects the mechanism from injury when the table is allowed to feed to the end of the rail.

The ram is of the V type, and a guard, forming part of the ram, prevents dirt from working its way into the bearings. The V-type of ram makes it possible to have both sides of the ram ways cast solid with the column and at the same time provide complete adjustment by means of a full length taper gib and a single screw, thereby taking care of any play, either sidewise or in a vertical direction.

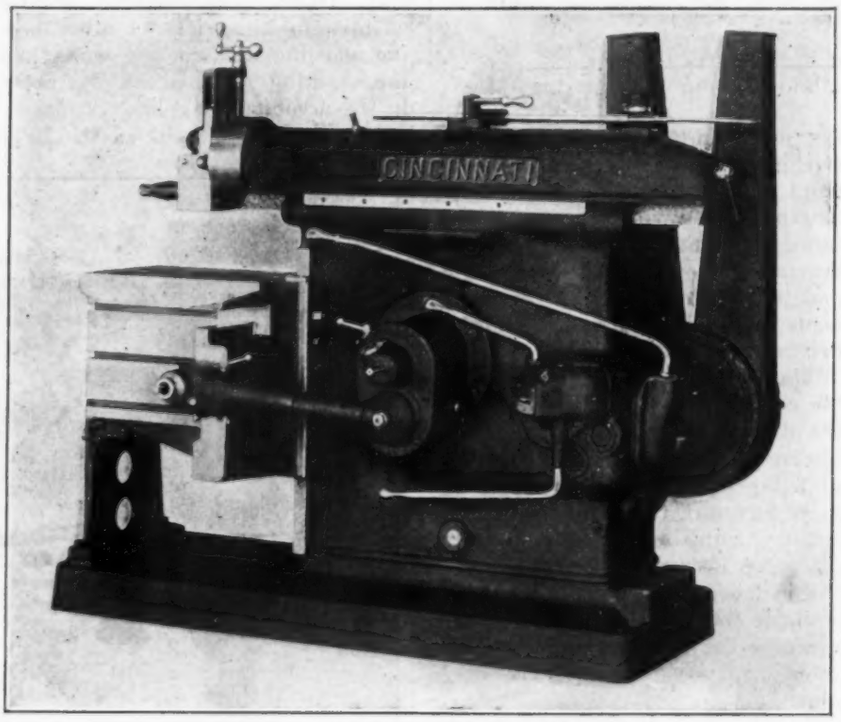


FIG. 1—CINCINNATI CLIMAX SHAPER

The movement of the ram clamp-lever is limited in its open position, so that no damage results to the adjusting screw if the operator accidentally fails to clamp it before starting a cut.

The ways of the tool slide are made with the male member of the dovetail on the head, which adds greatly to the strength and prevents the slide breaking at the sides. The toolpost is unusually large and the screw head is the same size as the

head of the vise screw, permitting the use of the long wrench when clamping heavy tools.

The column has heavily ribbed, dish-form sides, which resist the deflection resulting from the thrust of the crank bearing. The separate crank-gear bearing permits a solid crank-gear being used and makes possible a replacable bushing as in other bearings. The crank-gear journal is especially long and of two diameters, the enlarged portion be-

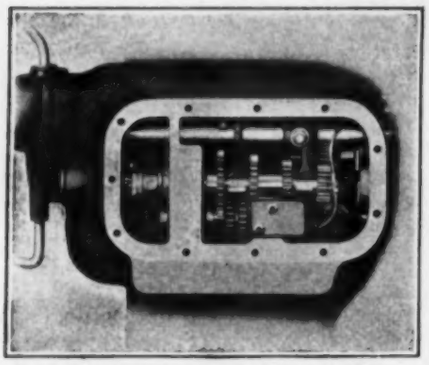


FIG. 2—SPEED GEAR CHAMBER

ing designed to provide additional strength and bearing surface at the point of greatest strain, while the length of the smaller portion maintains the alignment. The crank-gear bearing is close to the rocker arm, and in addition the gear portion is made to overhang, thus bringing the driving load well within the bearing.

The cross-rail is square locked to the column in order to better resist the direct thrust of the cut. Side alignment is maintained by means of a taper gib, and felt wipers remove any dirt from the face of the column while adjustment is being made. A heavy steel guard protects the rail bearing from chips, and is so made that it does not in any way decrease the working surface of the table, nor interfere with the operator.

The T-slots of the apron do not run entirely across but leave reinforcing ribs at the center and sides, adding greatly to the stiffness and strength. The apron is secured to the long narrow guide of the cross rail by taper gibs at the top and bottom. The table is almost a complete box section, only having small openings in the front and bottom. The spacing of the slots is such that the vise will fit either the top or sides. The table support is so made that the sliding action takes place at the base of the table, and with this type of support the parallel action is not dependent upon the exact alignment of the base of the machine.

Particular attention has been given to the matter of lubrication and the thorough protection of all bearings. The lubricating system consists of a plunger type pump in the gear case which delivers oil to a sight-feed distributing station located on top of the column near the belt guards. The level of the oil is visible through a glass gage. A surplus of oil is furnished to the distributing station and in the return of this surplus to the pump, it floods the main gear bearing and feed mechanism. Wicks in the distributing station feed the pipes leading to all parts of the machine.

The belt and pulley guard is adaptable to any driving condition, as it can easily be arranged for either open or crossed belts, or for large or small pulley whether directly overhead or otherwise.

This line of shapers is furnished in seven models. Five sizes, the 16-, 20-, 24-, 28- and 32-in. are of the heavy duty type, while two sizes, the 20- and 24-in. are of the standard type.

W & B Grinding and Reboring Machine

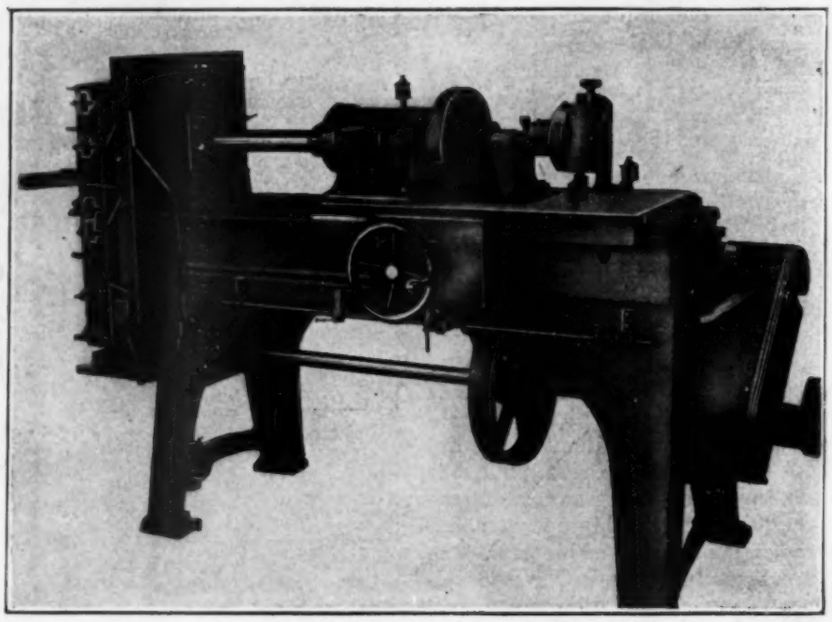
An automobile cylinder reboring and regrinding machine is a recent product of the Automotive Service Works, 1111 W. Main St., Oklahoma City, Okla. The machine is also adapted for a variety of other boring and internal grinding work, and the essential features will be noted in the accompanying illustration.

The work is clamped on the large faceplate at the left-hand end of the machine, and can be lowered or raised and moved sidewise to properly position the work in relation to the spindle. The faceplate is mounted directly upon the bed of the machine, thus providing a solid support for the work.

The tool head or carriage slides on ways on the bed, one of which is V-shaped and the other flat. The carriage is held down on the ways by arched-spring gibs located under the side apron. Felt wipers for the ways are attached to the carriage. The carriage is fed automatically by a screw and may be traversed by means of a hand-operated rack and pinion, when the feed is disengaged.

The feed change gearing is of the jaw clutch type. The clutches are disengaged by the carriage at the end of its travel and a patented spring-and-fulcrum device causes them to be re-engaged. This construction makes it impossible for the carriage to stop until its entire stroke has been completed. The feed screw is driven through a worm gear, and the maximum travel of the carriage is 22 inches.

The grinding wheel spindle is made from seamless tubing and the emery wheel spindle is of nickel steel.



W & B BORING AND REGRINDING MACHINE

A bronze bearing is provided at the wheel end, and Fafnir double-row ball bearings at the pulley end. The grinding wheels runs at from 4,500 to 5,700 r.p.m. The planetary action of the grinding wheel is obtained in the usual way by means of two eccentric sleeves, in which the spindle is mounted. The relation of these eccentrics determines the throw of the wheel and the planetary action is given by driving the outer sleeve by a belt.

The wheel truing fixture is attached to the faceplate and may be screwed up out of the way when not in use. When in operation, the boring head is screwed on the end of the grinding wheel mandrel.

The machine may be driven by a direct-connected motor or through tight and loose pulleys by a belt. The faceplate will accommodate work up to 6 ft. in diameter. The net weight of the machine is 900 lb., and the floor space required is 64x20 inches.

Hough Time Study Board

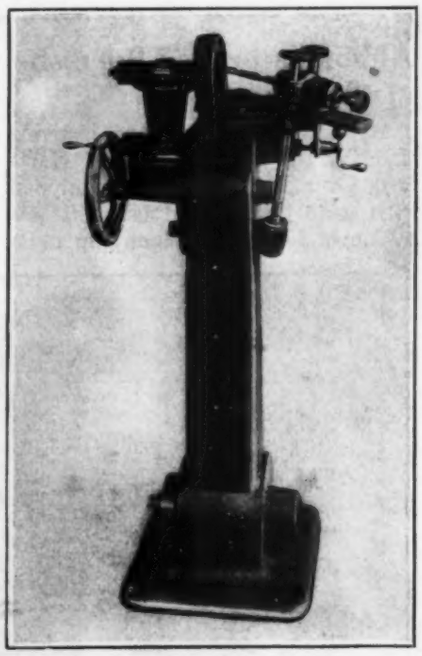
To aid in the production of accurate time study records the Stein & Ellbogen Co., 31 North State St., Chicago, Ill., has recently placed on the market the Hough time study board, shown in the accompanying illustration.

This board provides a writing surface upon which the record blank is held by a movable clip, enabling the operator to place the blank in the most convenient position. At the back of the board is arranged a storage place for relevant data and blank sheets. The time study watch is held in such a position that it can be easily operated by the left hand while the left arm holds the board, leaving the right hand free for making the record. The holder protects the watch and holds it securely in the best position to prevent glare and insure good visibility.

HOUGH TIME STUDY BOARD

Oliver No. 2 Automatic Drill Pointer

A machine for grinding drills from No. 60 to ½-in. inclusive, and which is known as the No. 2 automatic drill pointer, has recently been added to its line of tools by the Oliver Instrument Co., Adrian, Mich. The machine, shown in the accompanying illustration, is so designed that the motions of grinding a drill are entirely automatic and are produced by fixed mechanisms. It is of the pedestal type, the motor being located in the base of the machine and all working parts enclosed in the body of the machine, which also serves as a chamber for lubricating oil.



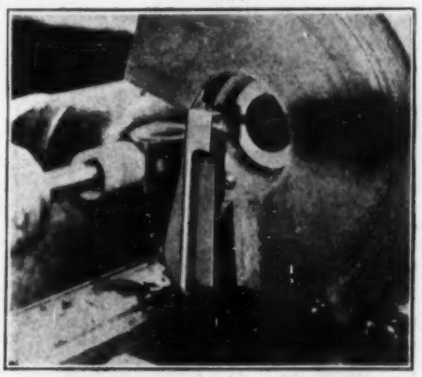
OLIVER NO. 2 AUTOMATIC DRILL POINTER

The grinding wheel is of the cup type, running at a speed of 3,950 r.p.m., and power is delivered by a ¼-hp. motor which runs at 1,750 r.p.m. The motor is built for any commercial service current, and is standard equipment. The drill-holder is made to take a No. 2 taper shank, and a No. 1 Morse taper sleeve is furnished for small drills. Straight shank drills are held in a Jacobs No. 3 chuck with a No. 2 Morse taper shank, which is placed in the drill-holder.

The drill-holder is connected with a cam action which is controlled by a handwheel, operation of the mechanism producing a synchronized motion by which the drill is rotated and advanced in timed relation to a forward and backward motion of the grinding wheel. The drill is rotated as the wheel oscillates past the point of the drill, the wheel advancing as it passes the drill and producing a clearance, the angle of which increases as the center of the drill is approached. It is claimed that the application of this principle will produce a theoretically correct drill point. Every size and type of drill is ground in the same manner, no skill being necessary for the operation of the machine. The machine is built to grind two-lipped drills only. The floor space required is approximately 24x36 in., and the net weight of the machihe is 310 pounds.

Teromatic Improved Wheel Dresser

A change has recently been made in the location of the wheel dresser on the Teromatic internal grinding machine, which is a product of the Giddings & Lewis Machine Tool Co., Fond du Lac, Wis. The wheel dresser was formerly located on the carriage of the machine, where it required hand adjustment for dressing the wheel. It is now located on the headstock, as shown in the illustration. Each time the wheel is brought clear of the work and returned to grinding position, which is usually after the piece has been



TEROMATIC IMPROVED WHEEL DRESSER

changed, it passes the diamond and is dressed. The cut taken across the wheel is very slight, but is enough to keep the wheel continually dressed and eliminates the necessity for losing time while dressing the wheel. After the wheel dresser has been set, it requires no further adjustment unless the wheel is changed.

Oilgear Self-Contained Double-Column Hydraulic Press

The Oilgear Co., Milwaukee, Wis., has recently placed on the market a line of self-contained, double-column hydraulic presses, built in several sizes ranging from 15 to 50 tons in capacity. The 15-ton press is shown in the accompanying illustration.

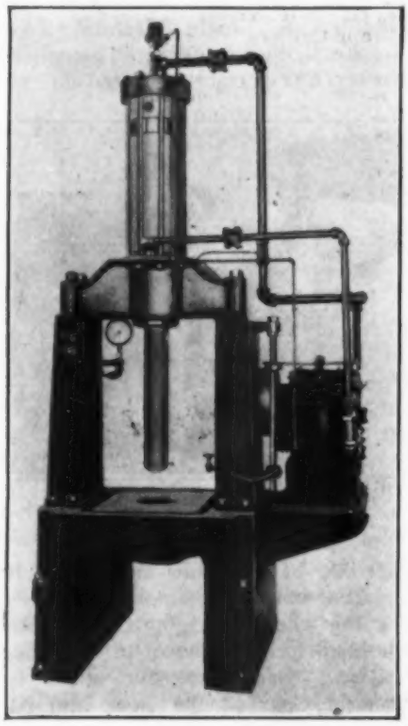
The press is equipped with the Oilgear, type-W, variable delivery pump, which was previously described on page 232, Vol. 59, of the *American Machinist*. This pump has a maximum delivery of 3,060 cu. in. of oil per min. and supplies the oil at a maximum pressure of 1,000 lb. per sq. in. Various control devices may be furnished for the pump including the plain hand control, shown in the illustration, a treadle, or a semi-automatic control.

A differential quick advance for the ram is available with the hand or foot control, which will allow the ram to be advanced to the work at double the pressing speed. The pump is so protected that the ram may be run against a positive stop without injury. It is also stated that the ram may be run against the work to any predetermined pressure, and held at that pressure indefinitely, without experiencing the pulsations that usually accompany such action on presses using the plunger type of pump.

The height of the platen above the floor in all sizes of this press is either 14 or 30 in., the greater dimension being obtained by an extension base as shown in the illustration. The machines are available with widths between the columns varying from 24 to 36 in., and the space between the bottom of the ram and the base with the ram up is made from 24 to 60 in.

The down speed of the ram varies from 103 in. per min for the 15-ton press to 30 in. per min. for the 50-ton size. The up speeds and the differential quick advance are approximately twice as great as the down speed values.

Among the advantages claimed for these presses may be mentioned sensitive control, smooth positive motion to ram, no accumulator required, no expensive operating valves, driven from any constant-speed source of power, protection against damage, endurance and speed. For motor driving a 5- to 7-hp. motor is recommended, to run at a constant speed of 1,200 r.p.m. and connected to the pump by a belt.



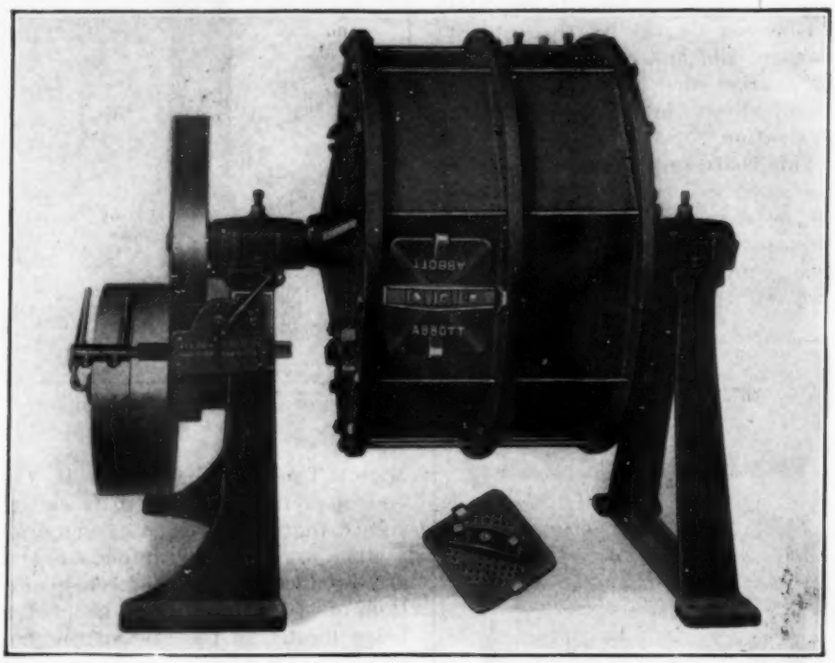
OILGEAR SELF-CONTAINED DOUBLE-COLUMN HYDRAULIC PRESS

Abbott Improved Burnishing Barrel

All of the burnishing barrels made by the Abbott Ball Co., Hartford, Conn., are now being equipped with gear guards and belt shifters as shown in the accompanying illustration. These features have been installed on some special machines manufactured previously by this company, and will hereafter be furnished as standard equipment.

Another improvement, designed to facilitate the washing out of the barrel, is a strainer cover, shown in the illustration below the machine. This cover is cast with a number of ½-in. holes in it, and is covered on the inside with a piece of wire cloth. The cloth is of the proper mesh to retain the smallest balls used. The strainer cover is used in place of the regular cover when rinsing out or draining the liquid from the barrel.

These barrels are made with one, two or three unit compartments, the one illustrated having two so that it is possible to run different kinds of articles in the same barrel. Each unit consists of an annular shell having flanges by which the units are held together. A sheet iron disk is placed between adjacent units to prevent communication from one to the other.



ABBOTT IMPROVED BURNISHING BARREL

News Section

November Output Is 325,125 Autos

Automobile production in the United States in November totaled 325,125 cars and trucks, a new high record for any corresponding month, and an increase of 50 per cent over the same period last year, according to records compiled by the National Automobile Chamber of Commerce. The total compares with an output of 365,107 cars and trucks in October and with 237,301 in the same month last year. In the eleven months ended with November production totaled 3,717,709 cars and trucks and total production of 4,000,000 cars and trucks is expected for the full year.

"Leaders in the automobile industry," says the statement issued by the Chamber, "believe the increases to be due to the national need for more transportation facilities, to the rapid development of suburban areas, and to the fact that better car values for the money are being offered than at any previous time, due to the economies of large scale production. Dealers throughout the country predict that motor car sales in the next few months will exceed last Winter. Improvement in the motor truck market also is expected in the larger cities."

Oakite Salesmen in Sales Conference

Fifteen years of Oakite service were completed at the seventh annual sales conference held at the general office of the Oakley Chemical Co., New York City, on Dec. 3, 4 and 5. Delegates to these conferences, the field organization of the company, are entertained from the minute they arrive at the hotel where rooms are reserved for them until their departure, and the meetings are scheduled so as to avoid confusion and delay.

On Monday morning after brief talks group photographs were taken and luncheon enjoyed at the Savarin. The afternoon session was devoted to the subjects of confidence in the company, the organization and its methods, the materials, the territory, and the sales plans. An open discussion on selling was continued in the evening after dinner.

The second day was devoted to the uses of Oakite in the various industries. These included textiles, dairies, laundries, mineral oil, metals, grinding, railroads and garages. In each case the best method of selling the industry followed the talk on the uses of Oakite in that industry. After dinner the party attended a musical comedy.

Power plant equipment, and vitreous enameling plants were the subjects for discussion on the morning of Dec. 5. These were followed by talks on methods of extending the use of Oakite materials in a plant. The afternoon talks were out of the ordinary, beginning with one by Maxwell Lakeman entitled, "Business Is as Good as We Make It." C. F. Radley spoke on the subject "Widening the Field of Activity"; A. W. Perry spoke on "Aggressiveness in Selling"; John A. Carter, "Habit and Sales Efficiency"; H. Liggett Gray, "Organization Gets Results"; J. Fred Tonn, "Know Then Thyself," and a talk by David S. Ball on "The Other Fellow." President D. C. Ball was in the chair.

The banquet at the McAlpin Hotel in the evening was most enjoyable with C. F. Radley as toastmaster. The prize winners of the different contests were announced. In the sales contest the winners were: J. A. Maguire, first; O. W. Hoster, second; and D. X. Clarin, third, while C. E. Barber, J. F. Ewing, T. H. Gritman and E. Lacy received honorable mention. The awards were based on the presentation of the most difficult sales story. In the 100 per cent Town Contest, the following field men qualified: C. E. Barber, G. M. Barnes, C. Burgin, A. L. Conant, M. W. Dennison, J. W. Eaton, J. H. Ellingsen, C. W. Everson, J. F. Ewing, J. E. Ginandt, H. Kennedy, G. W. Miller, C. P. Murphy, C. P. Orr, H. H. Reama, R. P. Reynolds, H. L. Trembicki, D. B. Turley and F. J. Wall.

The last session held the following morning was devoted to a conference of all district managers and in the afternoon the office girls of the company were entertained with a luncheon and a theatre party, so that all shared in the spirit of the occasion.

Richard P. Joy Treasurer of the Packard Co.

Richard P. Joy, president of the National Bank of Commerce, Detroit, has been elected treasurer of the Packard Motor Co. to succeed F. R. Robinson, resigned, it was announced last week following the annual meeting of the stockholders. The old board of directors was elected without change.

Mr. Joy's election to office, brings back to active interest in the company a name that has been more closely associated with it than any other since the organization of the Parkard Motor Co. in 1903.

Henry B. Joy, who was the first president, with a number of Detroiters, took over the interests of Warren Packard who was making motor cars in Warren, Ohio. One of the stipulations in the sale to the Detroit group in 1903 was that the product of the company was to bear the name Packard.

Mr. Joy was succeeded as president in 1916 by Alvan Macauley who has since presided as president of the company. In addition to the election of Richard P. Joy as treasurer, M. A. Cudlip, formerly assistant secretary, was promoted to the office of secretary.

October Earnings of Rails Large

Net earnings of the Class I railroads throughout the United States for the month of October were 4.72 per cent, according to the American Railway Association. These figures were based on an annual basis, so that while the percentage return was less than it has been for all but two months this year, the October earnings crossed the $100,000,000 mark for the first time this year. Net earnings figured in dollars totaled $102,746,000.

This is the largest amount that the railroads of the United States have earned in any one month for more than two years, and compares with a total earning of $85,205,600 in the same month of last year, which was at the annual rate of 4.05 per cent in September of this year the net earnings were at the rate of 4.46 per cent with a total of $98,238,384.

A large part of the increase in comparison with same month of last year was due to the increase in operating revenue, which amounted to approximately 7 per cent and which totaled $586,694,200. At the same time the operating expenses amounted to $444,937,800, an increase of $17,013,400 in comparison with October of 1922.

The Western district led in the rate earned with a percentage of 5.36, while the rate earned in the Eastern District was 4.02 per cent, and 5.26 per cent in the Southern district.

For the ten months this year the net operating income of the Class I railroads represented an annual rate of return of 5.20 per cent on their tentative valuation, amounting in dollars to $821,795,800, compared with $613,528,600, or 3.97 per cent for the same period last year.

Additional Factories for Fisher Corp.

Building of two new plate glass manufacturing plants, which are expected to result in the Fisher Body Corp. being able to supply its own demands for this material, was announced last week by Charles T. Fisher, vice-president of the corporation.

According to Mr. Fisher, the building program provides for the reconstruction and enlargement of the plate glass plant now at Blairsville, Pa., and for the erection of another plant at Ottawa, Ill., larger than the present plant in use there now.

These plants are both now operated by the National Plate Glass Co., a subsidiary of the Fisher corporation, headquarters of which are in Detroit.

It is estimated that the cost of the reconstruction of the Blairsville plant and the erection of the one at Ottawa will exceed $10,000,000.

Forty-Fourth Annual Meeting of A.S.M.E. Proves Successful

Fred. R. Low elected president—Medals presented to Frederick A. Halsey and John R. Freeman —Interesting papers in machine shop practice division—Many social features

IN THE auditorium on the third floor of the Engineering Societies Building, West 39th St., New York City, on Monday evening, Dec. 3, Fred. R. Low, editor of *Power*, was installed as president of the American Society of Mechanical Engineers. The installation was held directly following the retirement of John Lyle Harrington, who has served for the past year and who on this occasion delivered a masterly address to the assembled engineers attending the annual meeting that was in session Dec. 3 to 6 inclusive.

Mr. Harrington told of the achievements of the society since its inception and the ever present need of keeping the engineering profession free to perform its best duties. He stressed the point that engineers should receive more recognition for the services that they are rendering and he prophesied that this would be forthcoming within the very near future.

Mr. Harrington then presented to Frederick A. Halsey and John R. Freeman the Society Medals and diplomas for meritorious engineering work.

Following the installation of Mr. Low as president, Calvin W. Rice, secretary of the society, told of the work that the women could do in helping their husbands and also in founding scholarships in the various cities of the country for deserving young men who wished technical education. During Mr. Rice's talk he stated the astonishing fact that in the engineering profession, the members were continually changing their places of residence and that his records showed that fifty per cent of the members of the A.S.M.E. moved from one city to another at least once a year.

The retiring president and Mrs. Harrington, the newly elected president and Mrs. Low, Mr. and Mrs. Freeman and Mr. Halsey formed a receiving line in the left corridor of the auditorium and after members and guests had been given an opportunity of congratulating them, a reception was held on the fifth floor of the building where dancing and refreshments were enjoyed.

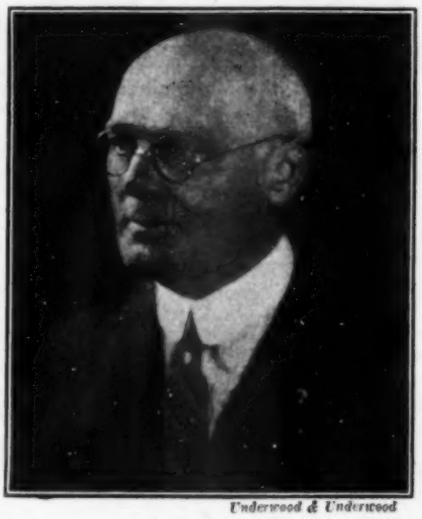
The Origin of the A.S.M.E.

Nearly 44 years ago, on Feb. 16, 1880, to be exact, a little group of engineers met in the office of the *American Machinist* to start what is now the largest engineering society in the country, the American Society of Mechanical Engineers. Since then the organization has grown mightily in numbers and prestige, certainly far beyond the wildest dreams of its founders. And now that the Society has grown to be a power in the industrial life of the nation, it is no more than fitting that it should select for its next president the editor of a paper closely associated with the *American Machinist*.

Mr. Low, editor of *Power* for 35 years, has probably done at least as much for the A.S.M.E. as any other one man. He has served on committees and held many of the offices at various times and has given unsparingly of his time. The highest honor the Society can bestow comes to him as a well-earned tribute to long and faithful service.

Of especial interest to the machine tool makers was the general session held Tuesday morning. H. A. S. Horwarth of the Kingsbury Machine Works, Philadelphia, Pa., presented a graphical study of journal lubrication and there were other problems discussed.

On Wednesday the economic phases



Underwood & Underwood

FRED. R. LOW

of coal shortage were discussed by F. G. Tryon of the United States Geographical Survey, Washington, D. C., in the fuel session, while in the ordnance session, Capt. H. W. Churchill, executive assistant in the New York district ordnance office, spoke on "Some Production Problems in the War Department's Preparedness Plan."

In the afternoon at the management session, R. T. Kent, consulting management engineer of Montclair, N. J., W. L. Churchill, of the Industrial Engineering Service, of New York City, and E. H. McKitterick of Lockwood, Green & Co., Boston, Mass., presented a symposium on the relation of mechanical engineering to management in the metal working, woodworking and textile industries.

Machine Shop Practice Session

One of the best meetings ever held by the machine shop practice division took place on Thursday morning. The retiring chairman of the division, F. O. Hoagland, presided.

The principal topic of the meeting was the pressworking of metals and two excellent papers were presented on the subject. The first one was read in very much abstracted form by Douglas P. Cook, president, Boston Pressed Metal Co., Worcester, Mass. Mr. Cook's subject was, "Pressed Metal Engineering: Some Principles and Examples." He gave an excellent picture of the strong strategical position of the young pressed metal industry and enlarged on the great opportunities awaiting the pressed metal engineer.

A number of slides were shown to illustrate a few of the many interesting cases of replacement by pressed metal designs of parts, sub-assemblies and complete assemblies made up of cast, forged and machined parts. In each case Mr. Cook gave figures on the actual savings in time and cost and pointed out the various other improvements due to the use of pressed metal. He concluded his presentation by showing a short motion picture of the various steps in producing one of the parts of a telephone. The picture was shown by courtesy of the Western Electric Co.

Mr. Galbreath's Paper

The second paper was given by W. W. Galbreath, president, Youngstown Pressed Steel Co., Warren, O., assisted by his general superintendent, John R. Winter. Mr. Galbreath took as his subject, "The Development of Modern Stamping Practice," which is published on page 883 in this issue. The discussion brought out the need for a lot of careful missionary work in order to acquaint the industry in general with the possibilities of pressed metal engineering.

The final paper of the meeting was a preliminary report on the present status and future problems of the art of cutting and forming metals. It was presented by the chairman of the committee entrusted with the problem, D. H. Blood, general manager of the Pratt & Whitney Co., Hartford, Conn. An abstract of this report appeared on page 841, Vol. 59, of the *American Machinist*.

To close the meeting Mr. Hoagland expressed the appreciation of the division for the work of the retiring members of the executive committee and asked the secretary, K. H. Condit, editor, *American Machinist*, to read the names of the committee for the ensuing year. The make-up of the committee is as follows: Chairman, James A. Smith, general superintendent, the General Electric Co., Schenectady, N. Y.; vice-chairman, George E. Greenleaf, chief engineer, the Niles-Bement-Pond Co., Plainfield, N. J.; chairman subcommittee on papers, J. A. Baker, research engineer, the Willys Overland Co., Toledo, O.; chairman sub-committee on publicity, F. O. Hoagland, the Saco-Lowell Works, Lowell, Mass.; chairman sub-committee on planning, Mr. Greenleaf; chairman sub-committee on membership, C. R. Gabriel, consulting engineer, the E. W. Bliss Co., Brooklyn, N. Y.

It is expected that steps will be taken immediately by the new committee to carry out the suggestions of the plan and scope special committee, whose report was accepted at the Montreal meeting last May.

The first papers presented at the aeronautic session dealt with the use

of various aluminum alloys and their resistance to salt water corrosion. The first was by D. Basch, research engineer of the General Electric Co., and M. F. Sayre of Union College, Schenectady, N. Y. The second was by Henry A. Gardner of the Gardner Laboratory, Washington, D. C., who added cleansing and protection to the data on corrosion.

Extracts of Archibald Black's paper on commercial aviation have already appeared in the *American Machinist*. The paper elicited considerable discussion on both sides. One contended that no planes of the capacity, he mentioned 600 hp., could be put into service in a year, while another stated that his company had such a plane which could take the air as soon as an engine could be installed.

Airplane Insurance

The insurance side of aviation was brought out forcibly by the statement that while ten companies started to insure planes a short time ago, only one remains and that they would only insure up to 50 per cent, the remainder being carried by Lloyds. Still another pointed out that the insurance companies were now following the lead of automobile custom and not insuring for such minor damage as smashed landing gear, etc., except at a special premium.

It was also pointed out that while night flying was essential for competition with the high speed, long distance trains, it was also advantageous for much express service, if it was to be of the greatest value. The contour of the country has much to do with the feasibility of night flying at present as emergency landing fields must be provided at frequent intervals.

The non-mathematical side of night flying was discussed in a paper by Lieutenants H. R. Harns and D. L. Brunner of McCook Field.

The social side of the annual meeting was thoroughly enjoyed by the attending members and their wives. Several interesting excursions were arranged to plants and stores in the city and there were teas, card parties and dances for the women.

On Tuesday evening at the Hotel Astor Roof a smoker and dinner was held and on Thursday evening the annual dinner dance was held in the Hotel Astor ball room.

Gage Sub-Committee Makes Report

The Plain Gage Committee of the American Society of Mechanical Engineers met on Dec. 4 to hear and discuss the report of the sub-committee on gages and gaging methods. The report was both exhaustive and illuminating and will do much to advance manufacturing methods if its suggestions are put into practice.

The report began with suggestions as to the use of gaging in manufacture of various kinds then defined the terms used and finally illustrated the various types of gages and suggested their uses. This is an important part of the work of the general committee and will be a valuable contribution to a very important subject. At the next meeting, Feb. 14 and 15 at the Bureau of Standards in Washington, D. C., it is hoped to get this report into shape for early publication.

Power Show Attracts Many Visitors

The many thousands of engineers who visited the Grand Central Palace in New York City during the week of Dec. 3 were rewarded by an extraordinary array of exhibits. Last year's "National Exposition of Power and Mechanical Engineering"—the first ever held—was a big success, but this second show has definitely surpassed it both in quantity and quality.

The exhibitors of last year had grown to 260—practically double—so that the entire mezzanine floor, as well as every nook and corner of the main floor, was needed to house exhibits. It seems highly probable that the final record of admissions for the week will greatly exceed the 47,580 that attended last year's show.

In addition to the large number of local engineers and executives, including members of the N.A.S.E. and A.S.M.E., there was a considerable attendance of out-of-town engineers. Many of these had been brought to New York by the double-headed attraction of a National Power Show and the annual meeting of the A.S.M.E. held simultaneously. Aside from the number of exhibitors and visitors the show was notable for the quality of its exhibits. Working models (and in some cases full-sized commercial units) of coal-handling equipment, stokers, powdered-fuel systems, water-softening systems and many other things held the interest of visiting engineers. In addition there were movies, special lectures and highly original demonstrations. This show must rank not only as the greatest Power Show, but also as one of the greatest industrial exhibitions ever held in this country. The exhibitors reported good business from the show.

Japan's Appreciation of Friendship

A friend in Japanese official circles shows his appreciation of American aid in the following effective manner.

"You can hardly imagine how thankful our people are for American aid. Your Ambassador was the most active of all the diplomats, being the first to see the urgent need of assistance and the most active in rendering aid, which he is still doing.

"The sympathy of all your people has made a deep impression upon the minds of our whole nation and I hereby heartily thank you, as a citizen of the U. S. A. The attached cartoon tells the story, the title being 'When it comes to sympathy, as in many other things, America is first of the whole world.'"

Industrials Buying Machine Tools in New York Market

With the exception of the New York Central R.R. practically no railroad buying of machine tools is reported this week in the New York City district. The Central has had a list out for about a month and is closing on some of the items this week. Other roads that have liste are not going to buy until after the first of the year when a rush of orders is expected from nearly every important road in the East. There is no question as to the needs. but the appropriations will not be forthcoming until 1924.

Dealers in machine tools state that the year has been a good one and that while some of the periods were a trifle slow, the twelve months taken together were very satisfactory. The month of November did not come up to expectations and December is not going to be any too bright unless there is an unexpected change before the end of the year.

One encouraging feature of the New York market this week is the number of general industrials that have purchased tools during the past two weeks. It is taken by the dealers as an indication of confidence in the future on the part of the industrialists.

Good business is reported by dealers in small tools and it was stated by one manufacturer's representative that there had been a better regular business during the past year than ever before, while improvement had also been noted in special designs, which is an important part of this branch of the machine tool business.

Used machine tools found a fair market during the week, but this business was not up to the pace of a month ago according to dealers in this line.

Indiana Prepares for January

Due largely, it is believed to seasonal influences, demand for machinery and tools is slowing up a little. The larger dealers in Indianapolis believe there will be but little demand until after the first of the year when the annual inventory period is over and a resume of the work done during the past year and the orders in sight for the next, determine the policies of the various companies duing 1924.

Some of the manufacturers in Indiana of specialized machinery say the volume of inquiries indicates a good business immediately after the first of the year. The general situation is somewhat spotted, some industrials buying both tools and machinery and others curtailing their purchases. Both tool and machinery men are optimistic and declare the general hedging of purchases during the early Winter months really a good thing inasmuch as it was not deemed advisable for a too rapid production expansion following the peak year of a couple or three years ago.

Woodworking Machinery Demand

Officials of E. C. Atkins & Co., manufacturers of saw-milling machinery, declare they can see no decrease in the demand. The large Southern and West coast lumber mills, while having curtailed their production somewhat, are preparing for further expansion after the first of the year to prepare for the early Spring lumber demand.

The demand from automotive industries in Indiana has been better this Fall than ever before in the history of the business, machinery men here say. Their tooling demands have been above the average, and in spite of financial difficulties in two of the oldest companies, production continues. The big increase in closed bodies has caused many of the plants to install much special machinery for this work. The Studebaker Co. is one of these and at the present time is unable to secure sufficient woodworkers to keep its body plant to the production desired.

Brick manufacturers are purchasing some machinery, but the demand is falling off and the trade here believes the season's purchases in this line are about completed. The coal mines have curtailed their purchases, due largely to the poor demand for bituminous coal in Indiana.

Chicago Has Many Inquiries

While inquiry for machine tools continues to improve in the Chicago district, the number of orders placed has not materially changed. The railroads were not active this week and the bulk of the orders placed was by industrials, who bought mostly single machines. The A. O. Smith Corp., Milwaukee, Wis., will not make purchases on its rather large list until next year, and dealers anticipate that the closing of other pending inquiries will not take place until after Jan. 1.

What the Railroads Want

The New York Central R.R. is inquiring for three or four punching and shearing machines. The Illinois Central R.R. is in the market for a 24-in. x 10-ft. engine lathe and a slotting machine. The Atchison, Topeka & Santa Fe Ry. is in the market for an automatic self-feed knife grinder. The Chicago & Northwestern Ry. is inquiring for a portable crank pin truing machine. The Michigan Central R.R. has placed an order with the Whiting Corp. for a 10-ton electric pillar crane. The Atchison, Topeka & Santa Fe Ry. has placed an order with the Shaw Electric Crane Co. for a 7½-ton electric traveling crane. The Victorian Government Rys. of Australia will receive bids until Jan. 9, 1924, for the following machinery: one spring coiling machine and all necessary equipment, including set of electrical motive apparatus; one taper rolling machine, including electrical motive apparatus; one combination turret lathe, including screws and nuts and taper turning attachment; one gear cutting machine; automatic cross cut saw; one cross grooving and trenching machine; one planing and thicknessing machine, including side cutters. The Chicago, Indianapolis & Louisville R.R. is in the market for an 18-in. tool room lathe with a 10-ft. bed equipped with taper attachment, to be motor driven, with motor using three phase, 60 cycle, 440 volt current.

Local industrial buying and inquiry indicate a special demand for sheet metal machinery and disk grinders. Planers are also active. Sales of second-hand machinery are larger in volume than might be expected when compared with new machine sales.

Cleveland Factories Enlarged

While not much can be expected in the way of new business for machine tool makers during the balance of this year, preparations that are being made by industries in the Cleveland district indicate that the new year will start off more satisfactorily that is usual so soon after Jan. 1. This belief appears to have a well-founded basis in the changes and expansions contemplated by manufacturing concerns.

In spite of what some may term as a lull in general business in the Cleveland territory, it cannot be denied that certain interests are not letting that theory deter them from an aggressive campaign for new business. To this end new quarters have been, or soon will be, acquired by not a few operators, and this in turn will mean, to some extent, an appreciable inquiry for new operating equipment.

Some of the latest plans announced in this connection include a new building for manufacturing purposes by the Chicago Pneumatic Tool Co., costing $50,000; another smaller structure for the Stotter Metal Co., to be used for foundry purposes; a $40,000 structure to be erected for and leased to the Electrical Auto Maintenance Co. and a $60,000 structure to be leasesd to the Acetylene Stove Manufacturing Co.

Reports of shutdowns of semi-finished material plants in the Cleveland district are significantly fewer in the last fortnight. In fact some are reported to have resumed operations again, or are about to do so.

South Has Year of Good Business

There have been substantially no changes worth mentioning in the machine tool conditions over the Southeastern territory during the past two weeks, distributors in Atlanta, Ga., report, with business generally quiet as it usually is at this time of the year, so far as orders for immediate delivery are concerned.

November sales proved to be slightly better than October, due to increasing activity in the placing of orders for delivery the early part of next year, while as compared with the November of 1922 sales this year appears to have been approximately 9 to 10 or 11 per cent better than last season. Reports of different distributors in this regard, however, show a very spotty tendency, one large dealer stating that his sales were around four to five per cent off as compared with last year. Most

dealers, however, enjoyed an increase both as compared with the previous month and the same month last year.

Inquiries are improving a little, but still appear to be slow. As was the case in November, though, inquiries are developing larger business than usual, due to the active demand that is being shown by the Southern railroads. But for this business machine tool sales would be considerably off as compared with a year ago. Railroads are doing more equipment buying in the South than they have ever done before, with the larger systems spending millions of dollars, and anticipating an even more active program during the coming year. Destruction of three or four large shops in the Southeast the past six months by fire has also served to create considerable machine tool business in this field, at least two of these fires destroying more than a million dollars worth of property. The railroads, too, are adding largely to their terminal and shop facilities, and establishing new shops in various important centers, and the demand for heavier machine tools is therefore much more active than usual.

Textiles Improve

The textile industry is beginning to show some signs of activity again with better inquiries being received that will result in some fairly good sales after the first of the year.

As yet the smaller shops are not increasing their activity, but a recent investigation by the secretary of the Southern Metal Trades Association, of Atlanta, indicates that these smaller shops are looking for a considerable activity early in 1924, which will likely serve to make them active buyers again of machine tools.

Spot cotton has continued to advance steadily, and is now above 35 cents at the Southern markets, the Federal Reserve Bank of Atlanta reporting that these increases place the South in the best financial shape it has enjoyed for years.

Machine tool and supply distributors of the district are growing more optimistic daily over the outlook for business during the early part of the coming year.

Detroit Outlook Is Encouraging

Swinging into December with every indication that conditions similar to those which have existed for the first 11 months of 1923 will prevail until the year is finally gone, Detroit manufacturers have announced but slight curtailment in production schedules, though the holiday and inventory period may cut down December totals materially.

There is nothing in prospect, however, to alter the prediction that the output for the year would reach 4,000,000 motor vehicles, as against 2,527,000 in 1922. Official figures for November have just been announced placing production at 325,000 autos and trucks which compares with 287,000 in the same month last year and 365,000 in October of this year.

Machine tool manufacturers consider the outlook for 1924 bright in view of the prevalent optimism in the automotive field. Just at present there is a slight lull in operations, but this is not unexpected, and in fact plans had been made to meet it.

Several new models of cars have been announced during the past week, and with the approach of the National Automobile Shows in New York, Detroit and Chicago during January, manufacturers are feverishly laying plans for securing the large orders usually attending these exhibitions.

December is holding its own in the automotive field, in the view of industrial leaders who affirm their belief in a continuation of Detroit's marvelous prosperity during the past year.

What is regarded as concrete evidence of healthy conditions is the report of 300 manufacturers affiliated with the Motor and Accessory Manufacturers' Association showing a great decrease in the volume of past due accounts and notes outstanding and a large increase in sales volume as compared with previous months and years. Sales to car and truck manufacturers of original equipment during October showed an increase of $7,000,000 over September, $15,000,000 above the total for October, 1922, and $31,000,000 greater than the October, 1921, volume.

Employment figures show an increase for the past week in spite of a slow and gradual decline for the previous five or six weeks. Present figures, according to the Employers' Association, are 214,377, an increase of 1,980 over the 212,397 of the previous week.

Philadelphia Awaits 1924 Activities

Resumption of railroad buying in considerable quantity will be delayed until Spring, according to the best information available among business men in the Philadelphia district. Railroad men in a position to know the plans of the roads assert there are indications of a repetition of enlargement of equipment and purchases in considerable quantities at that time.

At present the roads are finishing up an active Fall and early Winter season for which they made extensive preparations in the Spring by placing their equipment in shape for the busy freight moving season. Unless present indications fail, activities will again be resumed in the Spring of 1924.

Machine tool manufacturers in Philadelphia are watching with keen interest the railroad situation. Machine tool business has not changed materially from what it was two weeks ago. This was in line with what had been anticipated, with a seasonal lull in many branches of industry being apparent.

General Conditions Improved

The Federal Reserve Bank finds in its monthly summary of business that conditions generally present a tone of improvement, although in some industrial lines the condition is unsatisfactory. The employment situation is reported little changed from the previous month. There was a slight decrease in the number of wage earners in the Reserve District, embracing eastern Pennsylvania, New Jersey and Delaware. In 1,054 plants in the district there were 415,210 wage earners at work during the month, the bank's report states.

Business Is Fair in Cincinnati

There has been little change in the production of machine tools in the Cincinnati market during the past two weeks. There has been a slight slowing down in activity among a number of the houses as the end of the year approaches and conditions are likely to be rather quiet until well into January. Production during November measured up approximately to the same volume as October, but December will undoubtedly witness a decrease in the total sales and output of the Cincinnati plants. . Orders have been somewhat spotty in most branches of the industry, while inquiries have maintained an even pace during the last two months. An encouraging feature of the present market is the active buying that is being done by the automotive industry. Orders from this source have been coming in steadily during the last few weeks and there is no sign that there will be lessened buying during the rest of the year. The orders actually placed by railroads have not been numerous, but inquiries have been brisk and manufacturers look for substantial orders to break at any time.

December Is Dull

Manufacturers of milling machines and lathes state that their business is fair for this time of the year. Inquiries and sales are fairly good with little change recorded during the last month. The outlook for the next few weeks is not particularly promising, because the inventory period is now close at hand and many buyers will not place their orders until after the first of the year when their appropriation for purchases will have been authorized for 1924. The automotive industry has placed a number of good orders for lathes lately. Railroad buying has been at a minimum.

Several manufacturers of planers report that November was a fairly good month and showed sales in excess of October. December has started off well with these manufacturers who believe that the volume of production this month will compare favorably with that of last month. Several substantial orders for planers have been placed by automobile manufacturers while railroad buying has shown some strength. The orders for upright and radial drills have been rather spotty with business quiet. It is expected that this condition will continue until after the first of the year.

A steady volume of business has been maintained by the Cincinnati electrical tool houses. Manufacturers report that the purchases by the automotive industry have been exceptionally good in the past month. Officials of various plants believe that the good business will continue throughout December They attribute the steady sales to the wide field that they have to draw on and to the fact that their business is not seasonal.

The used machinery market is in fairly good shape. Taking the year as a whole, there has been much better business during 1923 than during 1922. Sales in November were encouraging and the volume of sales in December is expeced to be fair. Small lathes and grinders have been selling and inquiries have been plentiful.

The Industrial Review

Excellent prospects for the first quarter of the coming year—This year's business good

MACHINE tool dealers in all parts of the United States are looking eagerly toward the schedules that are being prepared for the first quarter of the coming year, and indications at this time point to a business that will equal the first quarter of 1923 —some dealers being optimistic enough to predict an increase. These claims are based upon the buying that it is reasonable to expect from the railroads, the automotive field, the general industrials, Japan and other foreign countries.

The schedules of most automobile manufacturers point to an increased production over that which has been enjoyed during 1923. The Ford company plans big increases, the General Motors Corp. has announced increases in all its plants and several of the other notable auto makers have expressed every belief that their production will be considerably greater than in 1923. From these statements recently given, the four million mark that was easily gained in 1923, will again be equaled by motor car builders during the coming year.

The railroads, that have done exceptionally well during the present year, plan to keep up their records during the coming year. This, of course, will mean expenditures for machine tools, and expansions are likely to occur in railroad repair shops as the earning power of the roads increase. With favorable legislation, railroad buying is expected to be more active next year than it was during this year.

Industrials Expanding

During the last quarter of 1923 expansions were noted in the general industrials which were somewhat unexpected and taken by machine tool dealers as an indication that these manufacturers have faith in the future. Business was not any too active from this source during the past twelve months, and it would seem that buying should be imperative during the first three months of the new year.

By the recent consolidation in Japan of three big companies making electrical goods, the reconstruction work will be speeded up and the ultimate purchasing of machine tools will come sooner than has been predicted since the disaster. At the New York offices of the various companies involved in the merger, it has been stated that definite lists of machine tools will be forthcoming during the latter part of January or the first part of February, and that actual buying will commence shortly afterward. Until that time, machine tool manufacturers will have to content themselves with the indirect benefits found in the selling to truck makers, machinery makers and others who are selling at the present time in Japan.

This year will prove to have been better than 1922 by from twenty-five to thirty per cent in volume of sales, according to prediction. The first six months of 1923 were satisfactory; the third quarter suffered from seasonal ills and also from an over-conservative buying attitude that was felt in all industries; and the last quarter showed an improvement over the third quarter, but a decrease as compared with the first two quarters.

Reports from various cities show that Cincinnati, Pittsburgh, Buffalo, Chicago and New England have done a steady business during the past two weeks; New York and Indianapolis have both shown an increased number of inquiries, but a decreased number of sales; Milwaukee and St. Louis have shown decreases in both sales and inquiries, while Philadelphia, Cleveland and Detroit have all shown increased activity in both sales and inquiries.

Electrical Business Good

Central station purchases of line construction material for the purpose of pushing outside construction work to completion before the coming of the first Winter storms was a feature of the market this week, both in New England and the northern states of the Middle West. Aside from this the main interest of both the wholesaler and the retailer has centered on the holiday market which is steadily increasing in its activity.

New England jobbers are buying other lines in small quantities, but the general feeling is that business is good. Electrical manufacturers are busy. In the New York section general business fell off a bit, but this was not considered important inasmuch as the dealer is intent on holiday trade. Good crops in the Southeast have stimulated building which is beginning to react in the electrical market on the demand for wiring material. Steady buying of radio and appliance lines continues in Chicago and there is a lively expectation there that there will be an increase in the price of rigid iron conduit and wire. Construction material and high-tension equipment holds steady. On the Coast Christmas selling seems to be running well ahead of previous years. Telephone and power extensions are active and creating a steady demand for wiring material. The building movement continues unabated, showing that general business is in a very satisfactory condition.

Railroads Electrifying

The interests of steam railroad men in heavy electric railroading is attested at the goodly number of such officials in attendance at the tests of electric locomotives held at Erie on Dec. 4. Great construction activity is looked for in the railway field if the electrification projects under consideration are carried out. The Illinois Central R.R., of course, is actually at work on the electrification of its suburban lines at Chicago. The Long Island R.R. has in contemplation the expenditure of $80,000,000 in the extension of its suburban electrification. Perhaps the most important project around New York is the so-called West side electrification in New York City proper. Kinks regarding grade-crossing electrification remain to be ironed out before this work goes ahead, but these things are expected to be settled at the coming session of the Legislature. Perhaps a little less than these are the proposed electrification undertakings by the Pennsylvania R.R. at Philadelphia and the electrification of the Mountain line west of Harrisburg. It is also known that the Baltimore & Ohio R.R. and the Chesapeake & Ohio R.R. are laying plans for somewhat similar work.

Bus Business

The bus business took on substantial gains during the past two weeks and indications are that this mode of transportation will become better organized as time goes on. Bus terminals and repair shops are noted in Newark, N. J., Bellingham, Wash., Sumner, Wash., Minneapolis, Minn. and other cities throughout the United States. The repair shops in Newark are being built by an association of bus owners and will cost $60,000 for the building and equipment.

Mines Working

Copper mining in the state of Michigan has fallen heir to a sudden prosperity and is making the most of it in buying new machinery and planning expansions. Other mining interests are doing as well as the weather will allow and reports from Arizona, Minnesota and Ontario are all favorable for December, and in fact for the entire mining year.

Coal mining is experiencing resistance to price and exceptionally bad weather for coal selling. However, production is healthy, although smaller than usual and conditions may be characterized as from fair to good.

Industrial Building

One of the important developments that machine tool makers should consider is the amount of industrial building that has been started during the months of October and November. Contracts for manufacturing expansion for over fifty million dollars were let during October as compared with approximately $23,000,000 in October, 1922, and during the month of November this year the contracts totaled about twenty-five and a half million dollars, whereas the average for the three previous years was less than $16,000,000.

These facts mean that buildings will be ready for machinery and machine tools in the Spring and that inquiries for requirements will be made during January and February.

Taking all industries into consideration, there is every indication of what may be termed a "bumper crop" of prosperity in store during 1924, and most schedules and plans of manufacturers for the coming year have been made accordingly.

The Business Barometer

This week's outlook in Commerce, Finance, Agriculture and Industry based on current developments

By THEODORE H. PRICE
Editor, *Commerce and Finance*, New York

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THOUGH the United States last week had to consider such important events as the President's message and the British elections they were both subordinate, in so far as their influence on business is concerned, to the continued inflow of gold from abroad and to the reported decision of the Federal Reserve authorities to resume the purchasing of government securities in the open market.

The reasons for the decision are varied. One is that the unemployed resources of the Federal Reserve System are now so great that open market operations are necessary to earn enough to pay the banks' extremely heavy overhead expenses. It has been estimated that a billion dollars a year must be steadily employed merely for this purpose.

To put the necessary amount of idle funds to work two alternative methods are feasible. One is to buy commercial paper, bankers' acceptances and similar obligations; the other to buy government bonds and treasury certificates. The effects of the two policies are very different. The first would enlarge the funds at the service of business and tend to reduce interest rates on them, while the second, which the board has chosen, will merely advance prices of securities, in effect taking them over from present holders at a profit with a possibility of later selling them back at a loss.

The choice clearly indicates that the policy of the Federal Reserve Board is to keep interest rates up instead of allowing them to follow their natural course. It is entirely consistent with the policy of camouflaging the true extent of our gold supply by forcing "yellow backs" into circulation, a policy which is only partially successful because imports continue extraordinarily heavy and advices from abroad indicate that they will be still heavier in coming weeks. Even the government officials who last Spring were saying that the gold tide would begin to flow away before the end of the year and that part of our store should be set aside for export are now compelled to sing a different tune.

Secretary Hoover points out that foreign buying of American securities has helped avert the expected gold outflow. As everyone knows, the use of our currency abroad is increasing steadily, and even steamship rates on British and French lines, from their own ports, are now fixed in dollars.

The fact is, whether the arbiters of credit choose to recognize it or not, that circumstances have again given the United States the opportunity to become the bankers of the world, ascending to the position of financial dominance which was Great Britain's before the war, when the notes of the Bank of England were virtually an international currency as the dollar is today.

But this opportunity will never be realized if interest rates are artificially maintained, and though I do not believe that any effort to keep them up can be entirely successful, even the attempt will subvert a share of the pre-eminence and the prosperity which the world is seeking to lay in the lap of this country.

So far as our domestic business is concerned, a definite assurance that we could enjoy the low interest rates to which our enormous credit reserves entitle us would be the most effective serum that could be injected into the business body to overcome the caution and hesitancy which mark the attitude of many men.

"On the other hand, some of the recent developments have helped business sentiment considerably. The President's vigorous support of Secretary Mellon's proposals for tax reduction confirms the belief that the secretary consulted 'headquarters' before making them public and increases the possibility of their passage, though most of the reliable reports from Washington say that the danger of the bonus is very real. The President's message in its entirety receives the warm approbation of practical men and is disappointing only to those visionaries who hoped for startlingly new proposals to solve some of our more pressing problems."

The mixed aspect of the business outlook is indeed due principally to the conflict of its factual and psychological phases. For one thing the proponents of the business cycle theory have succeeded in convincing many that a mild depression is to be expected until the middle of next year. For another, fear of high prices and "consumer resistance" is apparent in many places. If men govern themselves as though business is going to be dull of course it will be.

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Equally powerful in its psychological influence is the continued good tone of the stock market and the knowledge that there is plenty of money for the courageous who want to borrow it. This is the subtle effect of the unadmitted gold inflation which the Federal Reserve Board is trying to check, and which in the long run is likely to exert a decisive influence on the course of business.

Turning to facts, they are principally encouraging. The two mainsprings of last Spring's great activity, building and automobile manufacturing, are still wound up. The largest Winter building in our history, which is already assured, will employ thousands of men who are normally idle and lay the ground for booming materials markets when the Spring demand is added to the present buying. The persistence of automobile manufacturing at such high levels is one of the remarkable phenomena of this age; it has so confounded the prophets already that none dare say when the slump will come. Car loadings continue close to a million a week and would be even higher except for the seasonal drop in ore loadings.

Most of the basic commodities are steady in price. Although cotton is sharply lower for the week, a 2½-cent decline is not a very significant part of the 17-cent advance which it has had. Though iron and steel production is still declining prices are firmer and a revival of steel buying is generally expected after the inventory period is ended.

The British elections, resulting in a mandate for the retention of the historic free trade policy, are for the moment without significance to American business. But the possibility that Premier Baldwin's government will be forced out and replaced by another Coalition is worth considering for the more decided attitude such a government might take toward France. Meanwhile there is talk again of a loan to Germany which will probably not materialize, because it is unlikely that France will allow her claims to be subordinated to it.

Except for a revolt in Mexico, whose seriousness cannot yet be estimated, there is nothing in the foreign news of worse tenor than the dispatches of other weeks, and American business men have obviously made up their minds to remain impervious to even the worst reports from Europe.

Personals

J. B. HUNTER will have charge of the newly opened office of the Van Dorn Iron Works Co., Cleveland, Ohio, in Chicago. His headquarters will be at 311 Chamber of Commerce Building.

W. C. LEFEBVRE has been appointed manager of the traffic section, advisory staff of the General Motors Corp., with headquarters in Detroit, Mich.

W. F. PATTENGELL, who was credit manager of the Brier Hill Steel Co., Youngstown, Ohio, has resigned as secretary and treasurer of the Metropolitan Steel Co. and will become assistant to the president of the United Machine & Manufacturing Co., Canton, Ohio.

H. S. STOCKDALE has been appointed district sales manager with offices in Pittsburgh for the United Machine & Manufacturing Co., Canton, Ohio, engineer and manufacturer in the sale of its line of stokers, and separators.

ARTHUR B. LAKEY has been transferred from the San Francisco office to the Philadelphia office of the Kingsbury Machine Works.

CARL G. BARTH is leaving for Japan during December to act as technical expert for the Timius Olsen Testing Machine Co., Philadelphia. He will be gone for three years.

GEORGE G. HAMILTON recently resigned from the National Engine Hoisting Co. to become secretary-treasurer of the newly organized H. & O. Machinery & Engineering Co., Newark, N. J.

C. A. DUNN, recently appointed manager of the Delaware Seamless Tube Co., Auburn Pa., manufacturer of seamless cold drawn steel tubing was formerly sales manager of the Weldless Tube Co., Wooster, Ohio.

THOMAS H. THORN has been appointed district manager for the Terminal Engineering Co. of New York, for the Pittsburgh district. The company makes TEC trucks.

C. L. NAGEL will represent the Hilo Varnish Corp., Brooklyn, N. Y., in the Western territory, making his headquarters in Chicago at 2420 Washburne Ave.

KURT C. MARQUARDT has accepted a position as salesman with the New York office of the Union Twist Drill Co., Athol, Mass.

JAY J. SEAVER has been elected vice-president of Arthur G. McGee & Co., Cleveland, succeeding Donald D. Herr who was killed in the Japanese earthquake.

F. S. AUTY has been appointed advertising manager of Drying Systems, Inc., Chicago. Mr. Auty is on the staff of *Chatter*, the publication of the Machinery Club of Chicago.

EDWIN C. ANDREWS has been elected president and director of the Pierce-Brown Foundry Co. of North Tonawanda, N. Y., succeeding ALBERT M. EVERHARDT, who died a few months ago. Mr. Andrews has also been elected head of the Niagara Radiator & Boiler Co. of North Tonawanda, N. Y.

H. W. YEOMANS was elected president and W. B. PRINCE, vice-president of the Bishop & Babcock Co., Cleveland, Ohio, at a recent meeting of the directors.

JOHN R. LEE, former Ford Motor Co. executive and one of the founders of the Wills-Sainte Claire Co. with headquarters at Maryville, has been appointed assistant to the president of Dodge Brothers, Inc., according to announcement made last week by Frederick J. Haynes, president. Mr. Lee has been connected with the Dodge organization in an executive capacity for about a year. C. Harold Wills and he were the founders of the Marysville corporation, Mr. Lee being being vice-president and Mr. Wills president. Mr. Lee was generally credited with having been the father of the sociological aspects of the Wills-Sainte Claire venture, with its far-reaching plan for the model city of Marysville.

E. A. EMERSON, manager of the export department of the American Rolling Mill Co., Middletown, Ohio, has arrived in London from India and expects to sail for the United States during December. Mr. Emerson has been making a trip around the world in the interests of the export business of his company.

THOMAS DOUGHERTY, recently made manager of the sheet department of the Central Steel Co., Massillon, Ohio, was for the past few years connected with the claim department of the Sharon Steel Hoop Co., Sharon, Pa. He has already assumed his new duties.

A. A. ARNOLD, superintendent of the Galion Metallic Vault Co., Galion, Ohio, has resigned. He formerly was connected with the machine shops of J. B. McClintock & Co., known as the Galion Machine Works.

J. F. NEWMAN, for 12 years purchasing agent for the Weirton Steel Co., Weirton, W. Va., has become president of the Lawrenceville Bronze Co., Pittsburg, to succeed the late JOHN F. ROBERTSON. The Lawrenceville company manufacturers copper and bronze castings, specializing in blast furnaces, tuyeres, valve seats and rolling mill bearings.

P. T. LAWS has been named Southern district manager for the United States Cast Iron Pipe & Foundry Co., according to a recent announcement, with general offices in the American Trust & Savings Bank Bldg., at Birmingham, Ala. It is also announced that THOMAS P. ANTHONY has been appointed chief engineer of the company with offices at Burlington, N. J.

WALTER N. BALLOU has been appointed manager of the transportation division of the Atlanta office of the Westinghouse Electric & Manufacturing Co. and will have charge of the light and heavy traction business of the company in that territory.

SAMUEL REA, president of the Pennsylvania R.R., was elected president of the Long Island R.R. recently to succeed Ralph Peters, deceased. The election was in accordance with the policy of the railroad that the president of the Pennsylvania shall act as president of the principal companies of the system.

Business Items

The firm name of the Standard Tool & Manufacturing Co., Detroit, Mich., has been changed to the Standard Tube & Manufacturing Co.

The Standard Motor Parts Co., Racine, Wis., has changed its corporate name to the General Parts Corp.

The Colonial Tool & Forge Co. will move its plant and equipment from Columbiana, Ohio, to Elkton, Md. Eastern capital being interested in the expansion is the cause of the removal. There is being erected at Elkton a larger building than was used in Columbiana. The company was first incorporated in 1916 as the Harrold Forge & Tool Co. The name was changed about three years ago.

The New Metal Products Co., of San Francisco, has been incorporated with a capital stock of $750,000. The directors are Howard Spreckels, R. O. Bokee, W. E. Kettering, A. K. Harford and Wm. Kehoe. The latter, with offices in the Merchants Exchange Building, San Francisco, is attorney for the company.

The International Combustion Engineering Corp., New York, and Vickers, Ltd., of England have joined hands in the manufacture of power plant equipment, according to George E. Learnard, president of the International company. The arrangements, which were completed by Mr. Learnard, who has just returned from abroad, will in no way affect the business which is now being carried on by either company. Under the plan, a new company, to be known as Vickers & International Combustion Engineering, Ltd., will be organized in England with an initial capital of £500,000, owned in equal shares by the two compaiies interested.

Forthcoming Meetings

American Society for Steel Treating. Winter sectional meeting. Hotel Seneca, Rochester, N. Y., Jan. 31 and Feb. 1. W. H. Eisenman, secretary, 4600 Prospect Ave., Cleveland, Ohio.

Society of Automotive Engineers. Annual meeting, Jan. 22 to 25, at the General Motors Building, Detroit, Mich. Coker F. Clarkson, 29 W. 39th St., secretary.

American Gear Manufacturers Association. Spring Meeting. April 28, 29 and 30, 1924. Lafayette Hotel, Buffalo, N. Y.

Society of Industrial Engineers. Eleventh annual convention. Buffalo, N. Y. April 30, May 1 and 2. Headquarters, 608 S. Dearborn St., Chicago, George C. Dent, executive secretary.

Southern Supply & Machinery Dealers Association, National Supply & Machinery Dealers Association, and American Supply & Machinery Manufacturers Association. Triple convention, May 19, 20 and 21, 1924, Hotel Cleveland, Cleveland, Ohio. F. D. Mitchell, secretary-treasurer, 1819 Broadway, New York City.

Foreign Trade Council. Eleventh annual convention at Boston, June 4, 5 and 6. O. K. Davis, India House, Hanover Square, New York City, secretary.

The General Committee of Dividion V, Mechanical of the American Railway Association. Convention and exhibits. Atlantic City, June 11-18, 1924.

Railway Supply Manufacturers Association. Exhibit. Atlantic City, June 11-18, 1924.

New and Enlarged Shops

Machine Tools Wanted

Kan., Pittsburg—Cadillac Service Co., 219 South Bway, W. Gooch, Purch. Agt.—14 in. x 8 ft. lathe.

Kan., Pittsburgh—Drive It Yourself Co., 205 South Bway., V. Brunetti, Purch. Agt.—gear press.

Kan., Pittsburg—Ebert Motor Co., 309 South Bway., W. F. Ebert, Purch. Agt.—arbor press, electric valve grinder and weaver dolly.

Kan., Pittsburg—Jessner Welding Co., 202 West 3rd St., O. F. Jessner, Purch. Agt.—electric grinder.

Kan., Pittsburg—Mathews Motor Co., 301 North Pine St., C. S. Mathews, Purch. Agt.—electric drill, forcing press, cylinder and grinding attachments.

Kan., Pittsburg — Moore & Jenney, 209 South Bway., N. U. Moore, Purch. Agt.—forcing press, files and hand tools for automobile repair work.

Kan., Pittsburg—R. Ryan Electric Co., 913 North Bway. (electric and armature work), A. J. Fletcher, Purch. Agt.—lathe.

Kan., Pittsburg—E. Spicer, 201 West 3rd St.—reamers, gear pullers, boring machine, emery stand and wheel for automobile repairs.

Kan., Pittsburg—Super Garage, 507 Locust St., H. C. Hanson, Purch. Agt. forcing press and drill press.

Mass., Boston—J. A. Glass, 27 Purchase St. (metal worker) — combination punch, shears and angle cutter to handle up to at least ¾ in. plates (used).

Mass., Chelsea (Boston P. O.) — Union Metal Wks., 80 Carter St. (machine shop) —two No. 2 Warner & Swasey turret lathes.

Mass., Fall River — Center Garage Co., 101 2nd St.—small tools, including drills, reamers, pipe cutters and threaders, punches, taps, dies, wrenches, etc.; possibly larger tools, including drill press, lathe and hacksaw, later.

Mass., Worcester—Worcester Mchy. Co., 140 Commercial St. (machine shop)—pipe cutting and threading machine to take from 4 to 8 in. pipe or more (used).

Mo., Carthage—Carthage Fdry. & Machine Wks., 500 North Main St., F. L. Moore, Purch. Agt.—reboring machine, milling machine and planer.

Mo., Carthage—Darrow Motor Co., 509 South Main St., F. P. Darrow, Purch. Agt.—reboring machine.

Mo., Carthage—J. M. Hibbs, 427 Howard St.—arbor press and emery wheel with motor grinder.

Mo., Carthage—Larabee & Perkins, 132 East Central St.—drill press and small lathe for blacksmith and repair shop.

Mo., Carthage—C. J. Metcalf, 147 North Main St.—drill press (used) and forcing press.

Mo., Diamond—Ryno Garage & Taxi Service, McCorkle Bros., Purch. Agts.—lathe and electric drill (used preferred).

Mo., Diamond—J. C. Salesman (machine and blacksmith shop)—drill press and emery stand with two wheels.

Mo., Diamond—Starbs Garage & Machine Shop—lathe and drill press.

Mo., Granby—M. Long, R.R. 1—drill press for blacksmith shop.

Mo., Granby—Service Motor Co., H. G. Cline, Purch. Agt.—lathe for garage.

Mo., Joplin—Bell Motor Co., 418 Wall St., W. Bell, Purch. Agt.—electric grinder and drill.

Mo., Joplin—Central Machine Wks., 5th and School Sts., C. B. Kittrell and J. Wisdom, Purch. Agts.—18 in. x 12 ft. lathe, also belt driven shaver and bandsaw.

Mo., Joplin—Drillers Supply Co., 4th St. and Cox Ave., F. Boyer, Purch. Agt.—one hollow spindle, one 18 in. x 14 ft. and one 8 in. x 24 ft. lathe, also pipe threader and drill press.

Mo., Joplin—Empire Electric Mchy. Co., 4th and Pennsylvania Sts. (manufacturer of motors), R. E. Covert, Purch. Agt.—drill press, shaper and balancing table.

Mo., Joplin—F. A. Holden, 2025 Wall St. (machinist)—shaper.

Mo., Joplin—Hudson Supply & Service Co., 6th and Wall Sts.—14 in. x 6 ft. lathe.

Mo., Joplin—E. A. Martin Machine Co., 5th and School Sts.—inside keyseater.

N. Y., Brooklyn—Grim & Cummings, 57 Frost St. (manufacturers of laundry machinery)—milling machine and lathe, 36 in. swing.

N. Y., Buffalo—C. Doetterl, 444 Monroe St.—equipment for garage repair shop.

N. Y., Buffalo—J. E. Hubbard, 204 Norwood Ave.—equipment for garage repair shop at 105 College St.

N. Y., Niagara Falls—R. D. VandeBogart, Elmwood Ave.—tools and equipment for garage.

N. Y., Utica—Gibbs & Benway, Cronk Bldg., Hotel St., E. R. Gibbs, Purch. Agt.—small lathe and tools for garage repair shop.

O., Columbus—J. F. Ball Auto Service, 208 North 3rd St.—machinery, including grinder and small lathe, to enlarge repair shop.

O., Columbus — Madden-Atkinson Auto Co., 399 East Main St., I. Madden, Pres.—equipment for service station, including grinder and drill press.

O., Lisbon—Ford Motor Co., O. C. Hawk, Purch. Agt.—tools and equipment for proposed repair department.

O., Oakharbor—Miller Garage, A. Miller, Purch. Agt.—tools and equipment for extension of repair department.

Ore., Eugene—Central Stage & Terminal Co., R. Shepard, Pres.—vulcanizing plant, machinery and tools, including lathes and shapers for proposed garage.

Pa., Juniata (Altoona P. O.)—M. C. Babcock, Roland Bldg., 511 4th Ave.—repair shop tools and equipment for garage.

Pa., Plymouth—Vercoe Motor Co., 12 East Main St.—small tools, press and repair shop equipment.

Pa., Somerset—Somerset Motor Sales Co., West Church St.—tools, equipment and small lathe for garage, to replace fire loss.

Wis., Milwaukee—A. Golabowski, 1039 11th Ave.—air compressor, drilling machine and emery wheel.

Wis., Milwaukee—V. M. V. Corp., c/o P. W. Voland, 3202 North Ave. (manufacturer of automobile accessories)—drill press and plating equipment.

Que., Montreal — G. Belleau, 1494 Ave. Hotel de Ville—machine shop tools and machinery.

Que., Montreal—D. Dion, 1029 Marquette St.—press, tools and equipment for garage.

Que., Montreal — E. Galarneau, 617 Colonial Ave.—garage repair tols and equipment.

Que., Montreal—H. Gourgon, 219 St. Philip St.—boring machine and emery wheel for garage.

Que., Montreal—N. Granato, 2854 Blvd. St. Laurent—small lathe and tools for garage.

Que., Montreal—W. Gunson, 759 St. Paul St., W.—lathe and facer for automobile repairs.

Que., Montreal—A. Jenner, 587 Aylmer St.—lathe, etc., for garage.

Que., Montreal—A. Jones, 2054 St. Lawrence Blvd.—drill press, etc., for automobile repairs.

Que., Montreal—M. Kiely, 243 William St.—equipment and tools for machine shop.

Que., Montreal—J. P. Leherault, 1712 Papineau Ave.—press and tools for garage.

Que., Montreal—J. Malo, 1330 De Montigny St., E.—general equipment for garage.

Que., Montreal—Martineau & Labelle, 38 Prince Arthur St., E. (plumbers)—tools and equipment, including pipe threader.

Que., Montreal—A. Neveu, 10 Monk Blvd.—small lathe and tools for garage.

Que., Montreal—I. Plention, 409 Ontario St., E.—boring machine and chain hoist for automobile repair shop.

Que., Montreal—Provost Freres, 2575 Notre Dame St., E. (machinists)—small grinder and drill press.

Que., Montreal—A. Racine, 1990 St. Dominique St.—tools, press and equipment for automobile repairs, etc.

Que., Montreal—J. Rolle, 581 St. Timothy St. (machinist)—catalogues and prices on drill press and lathe.

Que., Montreal—A. Thiverge, 489 Laval Ave.—automobile repair equipment.

Que., Montreal — E. Vanier, 504 Henri Julien St.—garage tools and equipment.

Que., Montreal—White & Ware, 51 City Councilors St. (plumbers)—pipe threading and cutting machine.

Que., Montreal—J. E. Wilder, 321 Bleury St.—complete equipment, including gasoline tank and pump, for garage at Notre Dame de Grace.

Que., Outremont—R. Joannett, 219 Van Horne Ave.—lathe and drill press for garage.

Que., Quebec—Pare, Ltd., 78 Augustin St., F. Pare, Purch. Agt.—repair tools and other equipment for garage.

Machinery Wanted

Ill., Chicago—R. E. Martin, 6657 Ellis Ave.—one single stage, 12 x 12 in. belt driven air compressor (used).

Ill., Chicago—Mining Gazette Co., c/o Western Newspaper Union, Box R-110—16 or 20 page stereotype machine, press and complete outfit.

Ill., Lombard—The Printer, Box 396—job printing press, paper cutter, pulleys, hangers and belting.

Ia., Guttenberg — Kuempel Co. (job printers)—28 in. paper cutter.

Kan., Junction City—C. H. Manley—job printing press and Miller feeder.

Kan., Pittsburg — B. & W. Motor Co., 4th and Locust Sts., W. L. Williams, Purch. Agt.—automatic air compressor, also combined post and hand drill.

Kan., Pittsburg—C. & A. Garage, 405 North Locust St., J. Goodwin, Purch. Agt.—portable crane.

Kan., Pittsburg—J. Lenski Tires, 106 West 3rd St.—tire changers and spreaders.

Kan., Pittsburg—Pittsburg Constr. Co., 318 South Bway., W. S. Shaw, Purch. Agt.—complete outfit for planing mill.

Kan., Pittsburg—Pittsburg Cornice Wks., 110 West 3rd St., W. C. Wilson, Purch. Agt.—slitting shears, square break.

Kan., Pittsburg—L. Russell Battery Sta., 412 North Locust St.—electric equipment for battery station.

Kan., Pittsburg — United Iron Wks., Locust St. along tracks of St. Louis-San Francisco Ry.—regrinding machine.

Ky., Louisville—Office of United States Engineer, P. O. Box 72—one hand hammer rock drill, heavy type, self rotating; 24, 36, 60, 84, 108 and 144 in. steels to fit above drill.

Mass., Boston—Hollingsworth & Whitney, 185 Devenshire St.—equipment for pulp and paper plant at St. Stephen, N. B.

Mich., Atlantic Mine—D. A. Stratton Co. (manufacturer of handles)—shaving machines and wood turning lathes.

Mich., Detroit—Peerless Portland Cement Co., 2408 1st Natl. Bank Bldg.—mechanical equipment, including crushers, conveyors, kilns, etc., for proposed $1,500,000 cement plant.

Mich., Highland Park (Detroit P. O.)—Ford Motor Co.—material handling equipment for proposed car delivery building at Seattle, Wash.

Mo., Carthage—H. E. Williams Mfg. Co., 440 North Main St.—machinery and tools for the manufacture of automobile accessories.

Mo., Center—Herald—newspaper folder.

Mo., Granby—J. H. DeBusk—finisher for shoe repairs.

Mo., Joplin—Erwin-Chapman Co., 222 West 4th St. (tires and tire repairs)—skiver and electric drill.

The Weekly Price Guide

Rise and Fall of the Market

Iron and Steel—Pig-iron sales smaller. No. 2 foundry iron $21@$22 per gross ton at Birmingham. Coke higher. Finished steel prices firm. Mills receiving inquiries involving large tonnages. Improved railroad demand for steel plates. Oil-storage tank plate requirements small. Structurals continue at $2.50 base, with $2.40 quoted on exceptionally large tonnages; bars, $2.40 per 100 lb., Pittsburgh.

Advances—Tone of copper market still optimistic; electrolytic rose ¼c. per lb. in week. Tin and lead markets strong; former up 1¼c. and latter, ⅛c. per lb. Solder advanced 1¼c. and cotton waste 1c. per lb. in New York, during week.

Declines—Zinc market sagging; declined ¼c. per lb. in week. Steel sheets down 5 to 10c. per 100 lb. at Pittsburgh mill; drop reflected in New York warehouses. Antimony market easy; down ¼c. per lb.

IRON AND STEEL

PIG IRON—Per gross ton—Quotations compiled by The Matthew Addy Co.:

CINCINNATI	
No. 2 Southern	$25.05
Northern Basic	24.00
Southern Ohio No. 2	24.00
NEW YORK—Tidewater Delivery	
Southern No. 2 (silicon 2.25@2.75)	28.00
BIRMINGHAM	
No. 2 Foundry	22.00
PHILADELPHIA	
Eastern Pa., No. 2x (silicon 2.25@2.75)	24.25
Virginia No. 2	28.17
Basic	24.00
Grey Forge	24.00
CHICAGO	
No. 2 Foundry local	24.50
No. 2 Foundry, Southern (silicon 2.25@2.75)	27.00
PITTSBURGH, including freight charge from Valley	
No. 2 Foundry	25.77
Basic	25.77
Bessemer	26.77

IRON MACHINERY CASTINGS—Cost in cents per lb. of 100 flywheels, 6-in. face x 24-in. dia., hub not cored, good quality gray iron, weight 275 lb.:

Detroit	4.75
Cleveland	4.75
Cincinnati	5.00@7.50
New York	5.00@5.50
Chicago	5.25@5.75

SHEETS—Quotations are in cents per pound in various cities from warehouse; also the mill base in large lots.

Blue Annealed	Pittsburgh	New York	Cleveland	Chicago
No. 10	2.90@3.00	4.34	3.75	4.00
No. 12	3.00@3.10	4.39	3.80	4.05
No. 14	3.10@3.20	4.44	3.85	4.10
No. 16	3.30@3.40	4.54	3.95	4.20
Black				
Nos. 17 and 21	3.70	4.30@4.55	4.45	4.70
Nos. 22 and 24	3.75	4.35@4.60	4.50	4.70
Nos. 25 and 26	3.80	4.40@4.65	4.55	4.75
No. 28	3.85	4.50@4.75	4.65	4.85
Galvanized				
Nos. 10 and 11	3.85@4.00	4.50@4.80	4.70	4.85
Nos. 12 and 14	3.95@4.10	4.60@4.90	4.80	4.95
Nos. 17 and 21	4.25@4.40	4.90@5.20	5.10	5.24
Nos. 22 and 24	4.40@4.55	5.05@5.35	5.25	5.40
No. 26	4.55@4.70	5.20@5.45	5.50	5.55
No. 28	4.85@5.00	5.50@5.75	5.80	5.85

WROUGHT PIPE (Welded)—Warehouse discounts are as follows:

	New York Black	New York Galv.	Cleveland Black	Cleveland Galv.	Chicago Black	Chicago Galv.
1 to 3 in. steel butt welded	48%	34%	55½%	43½%	50%	37%
2½ to 6 in. steel lap welded	44%	30%	53½%	40½%	47%	34%

Malleable fittings: Classes B and C, banded, from New York stock sell at list plus 4%; class A, plus 23%. Cast iron, standard sizes, 34% off.

SEAMLESS STEEL TUBING—Following base discounts are on 20 gauge or .035-in., round, cold-drawn tubing, ½-in. to 1-in., O.D., weighing 0.17 lb. to 0.36 lb. per ft. Cutting charge per 100 cuts, $1.50 to $1.58:

O.D. Inches	List Price per ft.	Differential Discount	O.D. Inches	List Price per ft.	Differential Discount
½	$0.09	50%	⅞	$0.16	35%
⅝	.11	45%	1	.18	31%
¾	.14	40%			

NOTE—The discounts are to be lowered by the following differentials in the case of regular .10-.20 carbon: 25,000 ft. or over, 83; 15,000 to 25,000 ft., 82; 5,000 to 15,000 ft., 81; 1,000 to 5,000 ft., 80; less than 1,000 ft., 79.

MISCELLANEOUS—Warehouse prices in cents per pound in 100-lb. lots:

	New York	Cleveland	Chicago
Open hearth spring steel (base)	4.50	6.00	4.20
Spring steel (light) (base)	6.00	6.00	6.00
Coppered Bessemer rods (base)	6.53	8.00	6.70
Hoop steel	5.19	4.66	4.55
Cold rolled strip steel	7.50	8.25	8.35
Floor plates	5.80	5.66	5.80
Cold drawn shafting or screw	4.40	3.90	4.30
Cold drawn flats, squares	4.90	4.40	4.80
Structural shapes (base)	3.64	3.46	3.30
Soft steel bars (base)	3.54	3.36	3.20
Soft steel bar shapes (base)	3.54	3.36	3.20
Soft steel bands (base)	4.39	3.61	3.95
Tank plates (base)	3.64	3.46	3.30
Bar iron (3.10@3.15 at mill)	3.54	3.36	3.20
Tool steel	11.00	.....	.....
Drill rod (from list)	55%	40@55%	50%

Electric welding wire, New York, 3/32, 8.35c.; ⅛, 7.85c.; 5/32 to ¼, 7.35c. per lb.

METALS

Current Prices in Cents Per Pound

Copper, electrolytic (up to carlots), New York			13.75
Tin, 5-ton lots, New York			48.87½
Lead (up to carlots), St. Louis	7.25	New York	8.00
Zinc (up to carlots), St. Louis	6.30	New York	6.75

	New York	Cleveland	Chicago
Aluminum, 98 to 99% ingots, 1-15 ton lots	26.20	27.00	28.50
Antimony (Chinese), ton spot	9.75	10.50	10.25
Copper sheets, base	21.00	21.00@21.25	23.00
Copper wire, base	16.25	19.00	16.25
Copper bars, base	20.00	22.50	19.50
Copper tubing, base	23.50	27.25	23.00
Brass sheets, base	17.75	22.00	18.75
Brass tubing, base	22.00	27.00	20.50
Brass rods, base	15.50	18.00	15.75
Brass wire, base	18.25	22.00	.....
Zinc sheets (casks)	10.25	10.45	.....
Solder (½ and ½), (case lots)	33.75	31.75	30.00
Babbitt metal (83% tin)	52.00	59.50	48@52
Babbitt metal (35% tin)	25.00	18.50	22@25
Nickel (ingot and shot)	29.00	.....	.....
Nickel (electrolytic)	32.00	.....	35.00

SPECIAL NICKEL AND ALLOYS—Price in cents per lb.

Malleable nickel sheet (base)	57.00
Hot rolled rods, Grade "A" (base)	55.00
Cold drawn rods, Grade "A" (base)	63.00

Shop Materials and Supplies

METALS—Continued

Copper nickel ingots	37.00
Hot rolled copper nickel rods (base)	45.00
Manganese nickel hot rolled rods "E"—low manganese (base)	57.00
Manganese nickel hot rolled rods "D"—high manganese (base)	60.00

Base price of monel metal in cents per lb., f.o.b. Huntington, W. Va.:

Shot	32.00	Hot rolled rods (base)	40.00
Blocks	32.00	Cold drawn rods (base)	48.00
Ingots	38.00	Hot rolled sheets (base)	42.00

OLD METALS—Dealers' purchasing prices in cents per pound:

	New York	Cleveland	Chicago
Copper, heavy, and crucible	11.75	11.00	11.50
Copper, heavy, and wire	10.75	10.50	10.75
Copper, light, and bottoms	9.50	8.75	9.75
Lead, heavy	5.75	5.25	6.00
Lead, tea	4.75	4.00	5.00
Brass, heavy, yellow	7.00		7.25
Brass, heavy, red	8.75	9.25	9.00
Brass, light	6.25	5.00	6.25
No. 1 yellow brass turnings	7.00	5.75	6.75
Zinc	3.75	2.75	3.75

TIN PLATES—American Charcoal—Bright—Per box.

		New York	Cleveland	Chicago
"AAA" Grade:				
IC,	20x28, 112 sheets	$25.10	$22.85	$18.50
"A" Grade:				
IC,	20x28, 112 sheets	21.40	18.00	17.00
	Coke Plates—Primes, 20x28 in.			
100-lb.,	112 sheets	14.00	13.00	14.50
	Terne Plates—Small lots, 8-lb. Coating			
IC,	14x20	8.25	6.55	7.40

MISCELLANEOUS

	New York	Cleveland	Chicago
Cotton waste, white, per lb.	$0.11@0.14	$0.15	$0.14
Cotton waste, colored, per lb.	.09@.14	.12	.10½
Wiping cloths, 13¼x13¼, per lb	9.00	36.00 per M	.16
Wiping cloths, 13¼x20½, per lb.		52.00 per M	.16
Sal soda, per 100 lb.	2.40	2.25	2.65
Roll sulphur, per 100 lb.	3.60	3.25	3.50
Linseed oil, per gal., 5 bbl. lots	.95	1.00	.94
Lard cutting oil (50 gal. bbl.) per gal	.55	.50	.67½
Machine lubricant, medium-bodied (50 gal. wooden bbl.), per gal.	.297	.35	.40
Belting—Present discounts from list in fair quantities (½ doz. rolls).			
Leather—List price, 2c. per sq.in., per ply:			
Medium grade	30–10%	30–10%	30–10%
Heavy grade	20–5–2½	30%	20–5–2½%
Rubber and duck:			
First grade	50–10–5%	50–10%	40–10%
Second grade	60–5%	60–5%	60–5%
Abrasive materials—In sheets 9x11 in.,			
No. 1 grade, per ream of 480 sheets:			
Flint paper	$6.30	$5.84	$6.48
Emery paper	9.90	11.00	8.80
Emery cloth	31.12	31.12	29.48
Emery disks, 6 in. dia., No. 1 grade, per 100:			
Paper	1.49	1.24	1.40
Cloth	3.38	2.67	3.20
Fire clay, per 100 lb. bag		.65	.60
Coke, prompt furnace, Connellsville	per net ton		4.50@5.00
Coke, prompt foundry, Connellsville	per net ton		5.50@6.50
White lead, dry or in oil	100 lb. kegs		New York, 14.00
Red lead, dry	100 lb. kegs		New York, 14.00
Red lead, in oil	100 lb. kegs		New York, 15.50

Comparative Warehouse Prices

New York	Unit	Current Price	Four Weeks Ago	One Year Ago
Soft steel bars	per lb.	$0.0354	$0.0354	$0.0304
Cold finished shafting	per lb.	0.044	0.0465	0.039
Brass rods	per lb	0.155	0.1475	0.17
Solder (½ and ½)	per lb.	0.3375	0.295	0.275
Cotton waste	per lb.	.11@.14	.10@.13	.09@.11½
Washers, cast iron (½ in.)	per 100 lb.	6.50	6.50	6.00
Emery, disks, cloth, No. 1, 6 in. dia.	per 100	3.38	3.38	3.02
Lard cutting oil	per gal.	0.55	0.55	0.50
Machine oil	per gal.	0.297	0.297	0.33
Belting, leather, medium	off list	30–10%	30–10%	30–10%
Machine bolts up to 1x30 in.	off list	45%	40–10%	40%

SHOP SUPPLIES

Current Discounts from Standard Lists

	New York	Cleveland	Chicago
Machine Bolts:			
All sizes up to 1x30 in.	45%	60%	50–5%
1⅛ and 1¼x3 in. up to 12 in.	15%	50–5%	50%
With cold punched hex. nuts up to 1 in. diam. (plus std. extra of 10%)	30%	$3.50 net	
With hot pressed hex. nuts up to 1x30 in. (plus std. extra of 10%)	35%	3.50 net	$4.00 off
Button head bolts, with hex. nuts	List net	List net	
Hex. head and hex. nut bolts	List net		65–5%
Lag screws, coach screws	45%		60–5%
Square and hex. head cap screws	60%	70%	70–10%
Carriage bolts, up to 1 in.x30 in.	35%	50%	50–5%
Bolt ends, with hot pressed nuts	45%		55%
Tap bolts, hex. head, list plus	35%		
Semi-finished nuts, ⅜ and smaller	65%		
Semi-finished nuts, ⅝ and larger	60%	70%	80%
Case-hardened nuts	50%		
Washers, cast iron, ½ in., per 100 lb. (net)	$6.50	$4.00	$4.00
Washers, cast iron, ⅝ in., per 100 lb. (net)	5.50	4.00	4.00
Washers, round plate, per 100 lb. Off list	1.50	4.00	4.00
Nuts, hot pressed, sq., per 100 lb. Off list	1.00	3.50	3.50
Nuts, hot pressed, hex., per 100 lb. Off list	1.00	3.50	3.50
Nuts, cold punched, sq., per 100 lb. Off list	1.00	3.50	3.50
Nuts, cold punched, hex., per 100 lb. Off list	1.00	3.50	3.50
Rivets:			
Rivets, ⅛ in. dia. and smaller	50%	60%	60%
Rivets, tinned	50%	60%	4½c. net
Button heads ¾-in., ⅞-in., 1x2 in. to 5 in., per 100 lb. (net)	$5.00	$3.60	$3.75
Cone heads, ditto (net)	5.20	3.80	3.85
1½ to 2-in. long, all diameters, *EXTRA* per 100 lb.	0.25		0.15
⅝ in. diameter *EXTRA*	0.35		0.15
½ in. diameter *EXTRA*	0.75		0.50
1 in. long, and shorter *EXTRA*	0.75		0.50
Longer than 5 in. *EXTRA*	0.50		0.25
Less than 200 lb. *EXTRA*	0.50		0.50
Countersunk heads *EXTRA*	0.45		$3.70 base

Mo., Joplin—F. M. Exendine, 1208 Jackson Ave. (cabinet maker and carpenter)—wood lathe (used).

Mo., Joplin — Peerless Machine Co., 4th and Michigan Sts., W. S. Sohosky, Purch. Agt.—duplex steam pump manufacturing tools.

Mo., Joplin—Vernon Asphalt Co., J. A. Lohmeyer, 208 North Sergeant St., Purch. Agt.—machinery for proposed asphalt plant at Nevada.

Mo., Kansas City—Wood Products Co., 3406 Garfield Ave., E. J. Bivins, Purch. Agt.—bandsaw.

Mo., New Hampton—J. W. Cover—newspaper press, job printing press, paper cutter, belting, hangers and pulleys (used).

N. Y., Buffalo — J. H. Knobloch, 79 Tamarack St.—equipment for the manufacture of concrete blocks.

N. Y., Buffalo—L. E. Wesselman, 318 Niagara St.—equipment for addition to laundry.

N. Y., Buffalo—C. G. Williams, 586 Jefferson Ave.—laundry equipment.

N. Y., Elba—W. Brown, Mechanic St.—blacksmith shop equipment and one acetylene welding outfit.

N. Y., La Salle — Kappauf & Alberts, Cayuga Drive—machinery and equipment for new planing mill.

N. Y., North Tonawanda—Wurlitzer Co., Niagara Falls Blvd. (manufacturer of organs)—machinery and equipment for extensive enlargement program.

N. Y., Ogdensburg—Banner Laundry, Catherine St.—machinery and equipment, to replace that which was destroyed by fire.

N. Y., Syracuse—The city, Bd. of Contract & Supply, F. E. Barry, Secy.—several lathes and sand papering machines for continuation schools.

N. Y., Troy—Van Zandts, Inc., 621 River St.—coal conveyor with elevator to handle 3 ton soft coal per hour, convey 125 ft. and elevate 18 ft.

O., Cincinnati — Amer. Laundry Mchy. Co., Ross and Section Aves.—machinery for expansion program.

O., Columbus—Amer. Column & Lumber Co., Brunson Bldg., M. W. Stark, Purch. Agt.—equipment for band sawmill in Virginia.

O., Columbus—Columbus Woodworking Co., 2034 Leanard Ave., W. A. Slatter, Genl. Mgr.—sticker, mortiser, molding machine and other woodworking equipment to enlarge mill.

O., Columbus—J. E. McNally Lumber Co., 1670 Snider Ave.—woodworking machinery to enlarge mill, about Feb. 15, 1924.

O., Fremont—Fremont Brass & Bronze Co., O. C. Wahl, Mgr.—general foundry equipment.

O., Marion—McQuate Rubber Co. (manufacturer of balls, etc.), W. W. McQuate, Purch. Agt.—machinery for addition to plant.

O., Middletown — W. B. Oglesby Paper Co., L. C. Anderson, Pres. three washer machines, four rotaries and other paper making machinery.

O., Portsmouth — Carlyle-Labold Brick Co.—equipment for proposed factory.

Okla., Commerce — Jefferson Highway Garage, E. Pierce, Purch. Agt.—complete welding outfit.

Okla., Quapaw—Quapaw Zinc Washboard Wks.—wood turning lathe.

Okla., Quapaw — T. W. Smith, Supt. of Schools—wood lathe, Universal saw, planer, belting and hangers (used).

Okla., Tulsa—Choctaw Portland Cement Co.—mechanical equipment for proposed $25,000 cement plant.

Pa., Sellersville—H. Geisel—machinery, tools and equipment for proposed $25,000 plant for the manufacture of cutlery at Perkasie.

Pa., Williamsport — Vallamont Planing Mill Co., 1009 Market St., J. C. Wilson, owner—machinery for proposed $150,000 mill.

Tex., Collinsville—E. C. Williams—complete outfit for sawmill.

Tex., Dallas — Trinity Portland Cement Co., Commonwealth Bldg.—machinery for proposed sacking department of cement mill, to replace fire loss.

Tex., Houston — York Eng. & Supply Co., 2201 Texas Ave.—pipe welding equipment, etc., for new shop.

Tex., McKinney—McKinney Examiner—14 x 22 in. job printing press.

Tex., San Antonio—H. T. Phelps, Hicks Bldg.—100 ton jaw crusher.

Wis., Fond du Lac—F. F. Pope, 23 West Division St.—one tire press for garage.

Wis., Lancaster—Herald—2 revolution, 7 column quarto newspaper press, belting and hangers.

Wis., Milwaukee—Advance Boiler & Tank Co., 3015 Walnut St.—one 2 ton triple chain hoist.

Wis., Milwaukee—Dallmann Machine & Mfg. Co., 912 Winnebago St. (manufacturer of gears, dies and tools), W. Schmidt, Purch. Agt.—die making machines.

Wis., Milwaukee—P. J. Fischer, 241 Rusk Ave.—small tools, air compressor, gasoline storage tank and pump for garage.

Wis., Milwaukee—M. J. Goodnetter, 384 22nd St.—emery wheel, gasoline storage tank and pumps for proposed $40,000 garage.

Wis., Milwaukee—Main Express Co., 116 Oneida St.—gasoline pumps, tanks and small tools for proposed $40,000 garage.

Wis., Milwaukee—Misericordia Hospital, 2224 Chestnut St.—laundry machinery, including mangles, extractors and mechanical dryer.

Wis., Milwaukee—Northwest Fence & Wire Co., c/o D. V. Holcomb, 960 45th St.—special wire working machinery.

Wis., Milwaukee—United Feed Dealers, Inc., 3601 National Ave. (manufacturer of cereals, etc.)—feed grinding machinery.

Wis., Randolph—Friesland Canning Co., W. Jones, Pres.—canning and conveying machinery for proposed $75,000 cannery.

Wis., Rice Lake—Specialty Mfg. Co. (manufacturer of automobile accessories), L. J. Erickson, Purch. Agt.—buffer, tool room lathe, emery wheel and stand.

Wis., Ripon — Ripon Produce Co. — separators, vats, belting and shafting for cheese factory.

Wis., Sheboygan—Badger Furniture Co., 14th and Kentucky Sts., J. A. Will, Purch. Agt.—sticker, polisher and saws.

Wis., Sheboygan—Sheboygan Paper Box Co., c/o W. Gorter, 801 North 9th St.—cutters and other paper box making machines.

Wis., Wautoma—F. Grimm—rock crushing and screening machinery.

Wis., Whitewater — Whitewater Press — punch press for job printing.

Alta., Calgary—National System of Baking, Ltd., E. A. Heagle, Purch. Agt.—complete bakery equipment.

B. C., Prince Rupert—Prince Rupert Sulphite Fibre Co., Ltd.—machinery for a 90 ton bleached sulphite pulp plant.

N. B., Black's Harbor—Connors Bros., Ltd., P. W. Connors, Purch. Agt.—equipment for enlarged plant.

N. S., Halifax—L. Newcombe, Chelucto Rd.—complete dairy equipment.

N. S., River Philip—V. F. Davison—complete equipment for blacksmith shop.

N. S., Ship Harbor—J. Lewis—woodworking equipment to replace fire loss.

Ont., Barrie—Warren Organ Co., S. R. Warren, Mgr.—special machinery and equipment for the manufacture of organs.

Ont., Hamilton—International Harvester Co., Sherman St., N.—equipment for new binder twine plant.

Ont., Owen Sound — North Amer. Bent Chair Co.—special machinery.

Ont., Toronto—Dominion Envelope & Cartons, Ltd., 98 Ontario St., H. Breckenridge, Secy.—equipment.

Ont., Woodstock—Canada Furniture Mfg. Co., Ltd., M. Rowe, Secy.—woodworking equipment.

Que., Lachine—Lachine Printing Co., 24 12th Ave., J. Lamarche, Purch. Agt.—job printing press and type.

Que., Montreal—Allard & Bourque, 369 Papineau Ave.—emery stand and wheel for garage.

Que., Montreal—Allard & Desnoyers, 190 Pie 9th Ave. (sashes, etc.)—bench tools, rip saw and bandsaw.

Que., Montreal—The City, H. A. Terreault, Dir. of Purch.—receiving bids until Dec. 17 for shop machinery.

Que., Montreal—G. Delisle, 20 Marquette St.—air compressor for garage.

Que., Montreal — Dominion Textile Co., Ltd., Victoria Sq.—machinery and equipment for proposed plant at St. Lambert.

Que., Quebec—E. Plamondon, 176 St. Olivier St.—equipment, tools, etc., for blacksmith shop.

Que., Montreal—F. Tremblay & Co., 372 William St.—machinery and small tools for planing mill.

Que., St. Lambert—St. Lambert Lumber Co., E. F. Kimpton, Purch. Agt.—machinery and equipment for sawmill.

Metal Working Shops

Calif., Los Angeles—C. F. Crawford, 6029 Hollywood Blvd., Hollywood, awarded the contract for the construction of a 2 story, 50 x 150 ft. garage on Ottawa St., here.

Calif., Los Angeles—C. A. Doody, c/o Walker & Eisen, Archts., Pacific Finance Bldg., awarded the contract for the construction of a 4 story, 150 x 150 ft. garage on 6th St. and Kenmore Ave. Estimated cost $280,000.

Conn., New Britain—Landers, Frary & Clark, Commercial and Center Sts., manufacturer of hardware specialties, awarded the contract for the construction of a 6 story, 65 x 160 ft. factory on Ellis St. Estimated cost $100,000.

Ill., Chicago—The Acme Garage Co., c/o Morton, Leviton & Co., Archts., 123 West Madison St., is having plans prepared for the construction of a 1 story, 120 x 125 ft. addition to garage at 921-935 North California Ave. Estimated cost $75,000.

Ill., Chicago — Francisco & Jacobus, Archts., 39 South La Salle St., will receive bids about Dec. 15 for the construction of a 3 story factory on Grand St. near Kenton St. for the Continental Can Co., 111 West Washington St. Estimated cost $500,000.

Ill., Chicago—S. D. Jonas, 133 West Washington St., awarded the contract for the construction of a 1 story garage on Lake and Homan Sts. Estimated cost $40,000.

Ia., Sioux City—The Illinois Central R.R. Co., 135 East 11th Pl., Chicago, is having plans prepared for the construction of shops, roundhouse, etc., here. Estimated cost $500,000. F. L. Thompson, Ch. Engr.

Ky., Louisville—Joseph & Joseph, Archts., Francis Bldg., will receive bids until Dec. 27 for the construction of a 1 story, 120 x 200 ft. factory for the manufacture of highway material, culverts, etc., on 17th and Magnolia Sts., for the Highway Iron Products Co., Columbia Bldg. Estimated cost $106,000. Noted Dec. 6.

La., New Orleans—The Checker Cab Co., Inc., St. Charles Hotel, plans to build a garage on a 60 x 400 ft. site on Poydras St. near South Rampart St. Estimated cost $40,000. J. Bistes, Pres. Engineer or architect not announced.

Md., Baltimore—The Standard Sanitary Mfg. Co., Bessemer Bldg., Pittsburgh, is having plans prepared for the construction of a 2 story, 171 x 350 ft. warehouse, 154 x 345 ft. enamel shop, 102 x 197 ft. cleaning house, 97 x 589 ft. foundry, 100 x 250 ft. machine shop, 107 x 132 ft. power house and a 100 x 120 ft. enamel power mill on 5th Ave. from 7th to Camp Holabird Sts., here. Estimated cost $2,000,000. S. Deischer & Sons, Farmers Bank Bldg., Pittsburgh, Archts.

Mich., Crystal Falls—F. E. Parmelee & Son, Archts., Iron Mountain, will receive bids until Dec. 15 (change of date), for the construction of a 1 story, 52 x 100 ft. garage, here, for the Webb Garage Co., Iron Mountain. Estimated cost $50,000. Noted Nov. 29.

Minn., St. Paul—The Willis Motor Co., 50 12th St., is having plans prepared for the construction of a 1 story, 100 x 150 ft. garage on Congress and Robert Sts. Estimated cost $40,000. Mather & Fleishbein, 442 Endicott Bldg., St. Paul, Archts.

Mo., St.—Louis — The Forest Spring Real Estate Co., 3710 Forest Park Blvd., awarded the contract for the construction of a 2 story, 75 x 182 ft. boring tool factory. Estimated cost $40,000. Davis Boring Tool Co., 3710 Forest Park Blvd., lessee.

Mo., St. Louis—W. P. McMahon, Archt., Title Guaranty Bldg., is receiving bids and will open same about Dec. 15 for the construction of a 4 story, 37 x 155 ft. automobile sales and service building for the Mendenhahl Motor Co., 2317 Locust St. Noted Nov. 8.

O., Cleveland—The Chicago Pneumatic Tube Co., 1241 East 49th St., is having plans prepared for the construction of a 3 story, 43 x 126 ft. addition to its factory. Estimated cost $50,000. T. P. Kinsman, Mgr. Private plans.

O., Cleveland—A. C. Spear, 13931 Kinsman Rd., is having plans prepared for the construction of a 1 story garage at 2612 Prospect Ave. Estimated cost $50,000. Private plans.

Ore., Eugene—The Central Stage & Terminal Co. will soon receive bids for the construction of a 3 story, 68 x 120 ft. garage, bus depot and hotel on Willamette St. Estimated cost $75,000. Private plans. R. Shepard, Pres.

Tenn., Etowah—The Louisville & Nashville R.R., 10th St. and Bway., Louisville, is receiving bids and will open same about Dec. 31 for the construction of a 1 story, 110 x 170 ft. machine shop, here. Estimated cost $50,000. W. H. Courtenay, Ch. Engr. Noted May 24.

Wis., Milwaukee—M. J. Goodnetter, 384 22nd St., is receiving bids for the construction of a 1 story, 40 x 120 ft. garage on North Ave. Estimated cost $40,000. Private plans.